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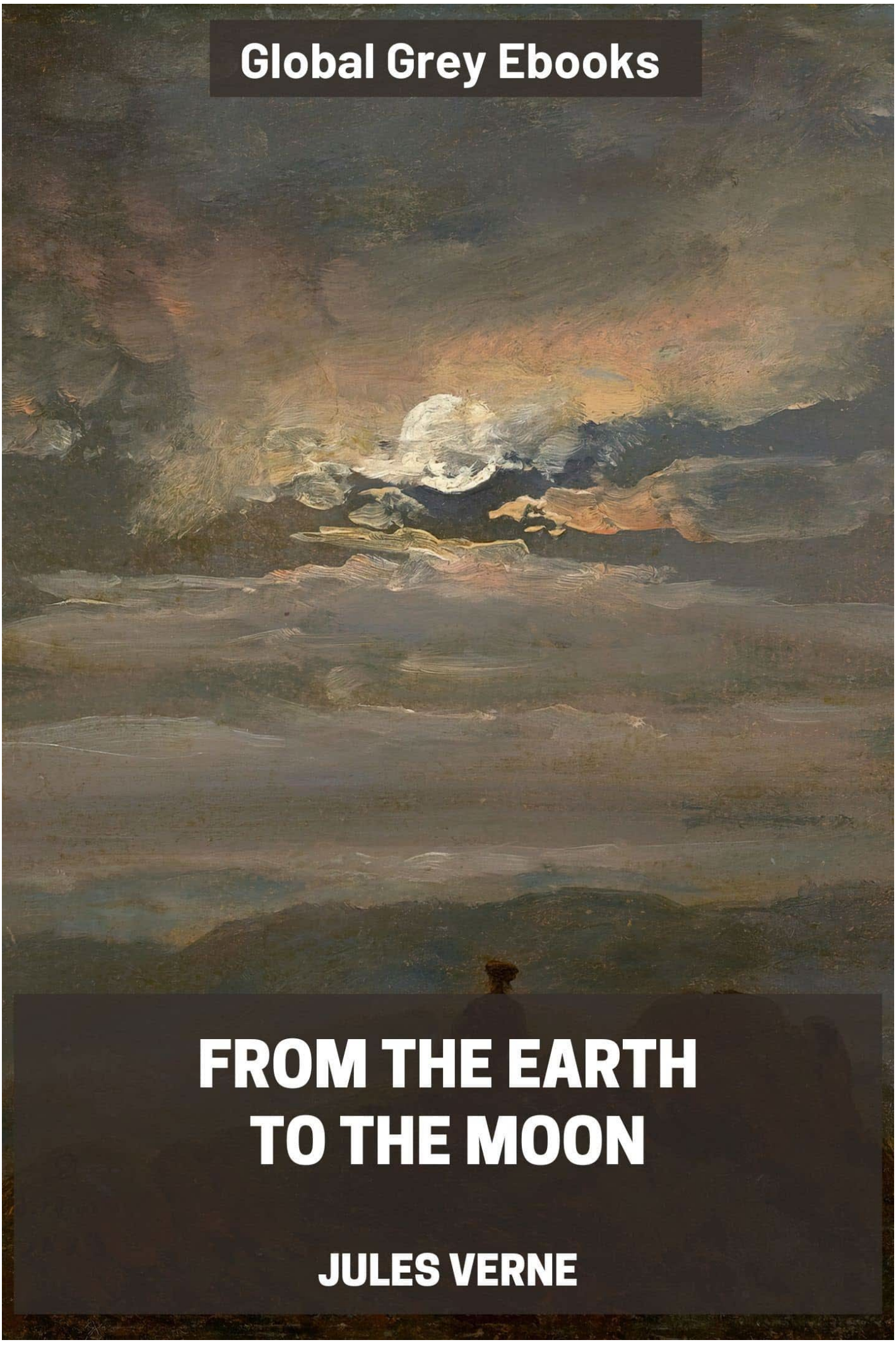

FROM THE EARTH TO THE MOON

JULES VERNE

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During the Federal war in the United States a new and very influential club was established in the city of Baltimore, Maryland. It is well known with what energy the military instinct was developed amongst that nation of shipowners, shopkeepers, and mechanics. Mere tradesmen jumped their counters to become extempore captains, colonels, and generals without having passed the Military School at West Point; they soon rivalled their colleagues of the old continent, and, like them, gained victories by dint of lavishing bullets, millions, and men.

But where Americans singularly surpassed Europeans was in the science of ballistics, or of throwing massive weapons by the use of an engine; not that their arms attained a higher degree of perfection, but they were of unusual dimensions, and consequently of hitherto unknown ranges. The English, French, and Prussians have nothing to learn about flank, running, enfilading, or point-blank firing; but their cannon, howitzers, and mortars are mere pocket-pistols compared with the formidable engines of American artillery.

This fact ought to astonish no one. The Yankees, the first mechanicians in the world, are born engineers, just as Italians are musicians and Germans metaphysicians. Thence nothing more natural than to see them bring their audacious ingenuity to bear on the science of ballistics. Hence those gigantic cannon, much less useful than sewing-machines, but quite as astonishing, and much more admired. The marvels of this style by Parrott, Dahlgren, and Rodman are well known. There was nothing left the Armstrongs, Pallisers, and Treuille de Beaulieux but to bow before their transatlantic rivals.

Therefore during the terrible struggle between Northerners and Southerners, artillerymen were in great request; the Union newspapers published their inventions with enthusiasm, and there was no little tradesman nor *naïf* "booby" who did not bother his head day and night with calculations about impossible trajectory engines.

Now when an American has an idea he seeks another American to share it. If they are three, they elect a president and two secretaries. Given four, they elect a clerk, and a company is established. Five convoke a general meeting, and the club is formed. It thus happened at Baltimore. The first man who invented a new cannon took into partnership the first man who cast it and the first man that bored it. Such was the nucleus of the Gun Club. One month after its formation it numbered eighteen hundred and thirty-three effective members, and thirty thousand five hundred and seventy-five corresponding members.

One condition was imposed as a *sine quâ non* upon every one who wished to become a member—that of having invented, or at least perfected, a cannon; or, in default of a cannon, a firearm of some sort. But, to tell the truth, mere inventors of fifteen-barrelled rifles, revolvers, or sword-pistols did not enjoy much consideration. Artillerymen were always preferred to them in every circumstance.

"The estimation in which they are held," said one day a learned orator of the Gun Club, "is in proportion to the size of their cannon, and in direct ratio to the square of distance attained by their projectiles!"

A little more and it would have been Newton's law of gravitation applied to moral order.

Once the Gun Club founded, it can be easily imagined its effect upon the inventive genius of the Americans. War-engines took colossal proportions, and projectiles launched beyond permitted distances cut inoffensive pedestrians to pieces. All these inventions left the timid

instruments of European artillery far behind them. This may be estimated by the following figures:—

Formerly, “in the good old times,” a thirty-six pounder, at a distance of three hundred feet, would cut up thirty-six horses, attacked in flank, and sixty-eight men. The art was then in its infancy. Projectiles have since made their way. The Rodman gun that sent a projectile weighing half a ton a distance of seven miles could easily have cut up a hundred and fifty horses and three hundred men. There was some talk at the Gun Club of making a solemn experiment with it. But if the horses consented to play their part, the men unfortunately were wanting.

However that may be, the effect of these cannon was very deadly, and at each discharge the combatants fell like ears before a scythe. After such projectiles what signified the famous ball which, at Coutras, in 1587, disabled twenty-five men; and the one which, at Zorndorff, in 1758, killed forty fantassins; and in 1742, Kesseldorf’s Austrian cannon, of which every shot levelled seventy enemies with the ground? What was the astonishing firing at Jena or Austerlitz, which decided the fate of the battle? During the Federal war much more wonderful things had been seen. At the battle of Gettysburg, a conical projectile thrown by a rifle-barrel cut up a hundred and seventy-three Confederates, and at the passage of the Potomac a Rodman ball sent two hundred and fifteen Southerners into an evidently better world. A formidable mortar must also be mentioned, invented by J.T. Maston, a distinguished member and perpetual secretary of the Gun Club, the result of which was far more deadly, seeing that, at its trial shot, it killed three hundred and thirty-seven persons—by bursting, it is true.

What can be added to these figures, so eloquent in themselves? Nothing. So the following calculation obtained by the statistician Pitcairn will be admitted without contestation: by dividing the number of victims fallen under the projectiles by that of the members of the Gun Club, he found that each one of them had killed, on his own account, an average of two thousand three hundred and seventy-five men and a fraction.

By considering such a result it will be seen that the single preoccupation of this learned society was the destruction of humanity philanthropically, and the perfecting of firearms considered as instruments of civilisation. It was a company of Exterminating Angels, at bottom the best fellows in the world.

It must be added that these Yankees, brave as they have ever proved themselves, did not confine themselves to formulae, but sacrificed themselves to their theories. Amongst them might be counted officers of every rank, those who had just made their *début* in the profession of arms, and those who had grown old on their gun-carriage. Many whose names figured in the book of honour of the Gun Club remained on the field of battle, and of those who came back the greater part bore marks of their indisputable valour. Crutches, wooden legs, articulated arms, hands with hooks, gutta-percha jaws, silver craniums, platinum noses, nothing was wanting to the collection; and the above-mentioned Pitcairn likewise calculated that in the Gun Club there was not quite one arm amongst every four persons, and only two legs amongst six.

But these valiant artillerymen paid little heed to such small matters, and felt justly proud when the report of a battle stated the number of victims at tenfold the quantity of projectiles expended.

One day, however, a sad and lamentable day, peace was signed by the survivors of the war, the noise of firing gradually ceased, the mortars were silent, the howitzers were muzzled for long enough, and the cannon, with muzzles depressed, were stored in the arsenals, the shots

were piled up in the parks, the bloody reminiscences were effaced, cotton shrubs grew magnificently on the well-manured fields, mourning garments began to be worn-out, as well as sorrow, and the Gun Club had nothing whatever to do.

Certain old hands, inveterate workers, still went on with their calculations in ballistics; they still imagined gigantic bombs and unparalleled howitzers. But what was the use of vain theories that could not be put in practice? So the saloons were deserted, the servants slept in the antechambers, the newspapers grew mouldy on the tables, from dark corners issued sad snores, and the members of the Gun Club, formerly so noisy, now reduced to silence by the disastrous peace, slept the sleep of Platonic artillery!

“This is distressing,” said brave Tom Hunter, whilst his wooden legs were carbonising at the fireplace of the smoking-room. “Nothing to do! Nothing to look forward to! What a tiresome existence! Where is the time when cannon awoke you every morning with its joyful reports?”

“That time is over,” answered dandy Bilsby, trying to stretch the arms he had lost. “There was some fun then! You invented an howitzer, and it was hardly cast before you ran to try it on the enemy; then you went back to the camp with an encouragement from Sherman, or a shake of the hands from MacClellan! But now the generals have gone back to their counters, and instead of cannon-balls they expedite inoffensive cotton bales! Ah, by Saint Barb! the future of artillery is lost to America!”

“Yes, Bilsby,” cried Colonel Blomsberry, “it is too bad! One fine morning you leave your tranquil occupations, you are drilled in the use of arms, you leave Baltimore for the battle-field, you conduct yourself like a hero, and in two years, three years at the latest, you are obliged to leave the fruit of so many fatigues, to go to sleep in deplorable idleness, and keep your hands in your pockets.”

The valiant colonel would have found it very difficult to give such a proof of his want of occupation, though it was not the pockets that were wanting.

“And no war in prospect, then,” said the famous J.T. Maston, scratching his gutta-percha cranium with his steel hook; “there is not a cloud on the horizon now that there is so much to do in the science of artillery! I myself finished this very morning a diagram with plan, basin, and elevation of a mortar destined to change the laws of warfare!”

“Indeed!” replied Tom Hunter, thinking involuntarily of the Honourable J.T. Maston’s last essay.

“Indeed!” answered Maston. “But what is the use of the good results of such studies and so many difficulties conquered? It is mere waste of time. The people of the New World seem determined to live in peace, and our bellicose *Tribune* has gone as far as to predict approaching catastrophes due to the scandalous increase of population!”

“Yet, Maston,” said Colonel Blomsberry, “they are always fighting in Europe to maintain the principle of nationalities!”

“What of that?”

“Why, there might be something to do over there, and if they accepted our services—”

“What are you thinking of?” cried Bilsby. “Work at ballistics for the benefit of foreigners!”

“Perhaps that would be better than not doing it at all,” answered the colonel.

“Doubtless,” said J.T. Maston, “it would be better, but such an expedient cannot be thought of.”

“Why so?” asked the colonel.

“Because their ideas of advancement would be contrary to all our American customs. Those folks seem to think that you cannot be a general-in-chief without having served as second lieutenant, which comes to the same as saying that no one can point a gun that has not cast one. Now that is simply—”

“Absurd!” replied Tom Hunter, whittling the arms of his chair with his bowie-knife; “and as things are so, there is nothing left for us but to plant tobacco or distil whale-oil!”

“What!” shouted J.T. Maston, “shall we not employ these last years of our existence in perfecting firearms? Will not a fresh opportunity present itself to try the ranges of our projectiles? Will the atmosphere be no longer illuminated by the lightning of our cannons? Won’t some international difficulty crop up that will allow us to declare war against some transatlantic power? Won’t France run down one of our steamers, or won’t England, in defiance of the rights of nations, hang up three or four of our countrymen?”

“No, Maston,” answered Colonel Blomsberry; “no such luck! No, not one of those incidents will happen; and if one did, it would be of no use to us. American sensitiveness is declining daily, and we are going to the dogs!”

“Yes, we are growing quite humble,” replied Bilsby.

“And we are humiliated!” answered Tom Hunter.

“All that is only too true,” replied J.T. Maston, with fresh vehemence. “There are a thousand reasons for fighting floating about, and still we don’t fight! We economise legs and arms, and that to the profit of folks that don’t know what to do with them. Look here, without looking any farther for a motive for war, did not North America formerly belong to the English?”

“Doubtless,” answered Tom Hunter, angrily poking the fire with the end of his crutch.

“Well,” replied J.T. Maston, “why should not England in its turn belong to the Americans?”

“It would be but justice,” answered Colonel Blomsberry.

“Go and propose that to the President of the United States,” cried J.T. Maston, “and see what sort of a reception you would get.”

“It would not be a bad reception,” murmured Bilsby between the four teeth he had saved from battle.

“I’faith,” cried J.T. Maston, “they need not count upon my vote in the next elections.”

“Nor upon ours,” answered with common accord these bellicose invalids.

“In the meantime,” continued J.T. Maston, “and to conclude, if they do not furnish me with the opportunity of trying my new mortar on a real battle-field, I shall send in my resignation as member of the Gun Club, and I shall go and bury myself in the backwoods of Arkansas.”

“We will follow you there,” answered the interlocutors of the enterprising J.T. Maston.

Things had come to that pass, and the club, getting more excited, was menaced with approaching dissolution, when an unexpected event came to prevent so regrettable a catastrophe.

The very day after the foregoing conversation each member of the club received a circular couched in these terms:—

“Baltimore, October 3rd.

“The president of the Gun Club has the honour to inform his colleagues that at the meeting on the 5th ultimo he will make them a communication of an extremely interesting nature. He

therefore begs that they, to the suspension of all other business, will attend, in accordance with the present invitation,

“Their devoted colleague,

“IMPEY BARBICANE, P.G.C.”

II. President Barbicane’s Communication

On the 5th of October, at 8 p.m., a dense crowd pressed into the saloons of the Gun Club, 21, Union-square. All the members of the club residing at Baltimore had gone on the invitation of their president. The express brought corresponding members by hundreds, and if the meeting-hall had not been so large, the crowd of *savants* could not have found room in it; they overflowed into the neighbouring rooms, down the passages, and even into the courtyards; there they ran against the populace who were pressing against the doors, each trying to get into the front rank, all eager to learn the important communication of President Barbicane, all pressing, squeezing, crushing with that liberty of action peculiar to the masses brought up in the idea of self-government.

That evening any stranger who might have chanced to be in Baltimore could not have obtained a place at any price in the large hall; it was exclusively reserved to residing or corresponding members; no one else was admitted; and the city magnates, common councillors, and select men were compelled to mingle with their inferiors in order to catch stray news from the interior.

The immense hall presented a curious spectacle; it was marvellously adapted to the purpose for which it was built. Lofty pillars formed of cannon, superposed upon huge mortars as a base, supported the fine ironwork of the arches—real cast-iron lacework.

Trophies of blunderbusses, matchlocks, arquebuses, carbines, all sorts of ancient or modern firearms, were picturesquely enlaced against the walls. The gas, in full flame, came out of a thousand revolvers grouped in the form of lustres, whilst candlesticks of pistols, and candelabra made of guns done up in sheaves, completed this display of light. Models of cannons, specimens of bronze, targets spotted with shot-marks, plaques broken by the shock of the Gun Club, balls, assortments of rammers and sponges, chaplets of shells, necklaces of projectiles, garlands of howitzers—in a word, all the tools of the artilleryman surprised the eyes by their wonderful arrangement, and induced a belief that their real purpose was more ornamental than deadly.

In the place of honour was seen, covered by a splendid glass case, a piece of breech, broken and twisted under the effort of the powder—a precious fragment of J.T. Maston’s cannon.

At the extremity of the hall the president, assisted by four secretaries, occupied a wide platform. His chair, placed on a carved gun-carriage, was modelled upon the powerful proportions of a 32-inch mortar; it was pointed at an angle of 90 degs., and hung upon trunnions so that the president could use it as a rocking-chair, very agreeable in great heat. Upon the desk, a huge iron plate, supported upon six carronades, stood a very tasteful inkstand, made of a beautifully-chased Spanish piece, and a report-bell, which, when required, went off like a revolver. During the vehement discussions this new sort of bell scarcely sufficed to cover the voices of this legion of excited artillerymen.

In front of the desk, benches, arranged in zigzags, like the circumvallations of intrenchment, formed a succession of bastions and curtains where the members of the Gun Club took their seats; and that evening, it may be said, there were plenty on the ramparts. The president was sufficiently known for all to be assured that he would not have called together his colleagues without a very great motive.

Impey Barbicane was a man of forty, calm, cold, austere, of a singularly serious and concentrated mind, as exact as a chronometer, of an imperturbable temperament and

immovable character; not very chivalrous, yet adventurous, and always bringing practical ideas to bear on the wildest enterprises; an essential New-Englander, a Northern colonist, the descendant of those Roundheads so fatal to the Stuarts, and the implacable enemy of the Southern gentlemen, the ancient cavaliers of the mother country—in a word, a Yankee cast in a single mould.

Barbicane had made a great fortune as a timber-merchant; named director of artillery during the war, he showed himself fertile in inventions; enterprising in his ideas, he contributed powerfully to the progress of ballistics, gave an immense impetus to experimental researches.

He was a person of average height, having, by a rare exception in the Gun Club, all his limbs intact. His strongly-marked features seemed to be drawn by square and rule, and if it be true that in order to guess the instincts of a man one must look at his profile, Barbicane seen thus offered the most certain indications of energy, audacity, and *sang-froid*.

At that moment he remained motionless in his chair, mute, absorbed, with an inward look sheltered under his tall hat, a cylinder of black silk, which seems screwed down upon the skull of American men.

His colleagues talked noisily around him without disturbing him; they questioned one another, launched into the field of suppositions, examined their president, and tried, but in vain, to make out the *x* of his imperturbable physiognomy.

Just as eight o'clock struck from the fulminating clock of the large hall, Barbicane, as if moved by a spring, jumped up; a general silence ensued, and the orator, in a slightly emphatic tone, spoke as follows:—

"Brave colleagues,—It is some time since an unfruitful peace plunged the members of the Gun Club into deplorable inactivity. After a period of some years, so full of incidents, we have been obliged to abandon our works and stop short on the road of progress. I do not fear to proclaim aloud that any war which would put arms in our hands again would be welcome—"

"Yes, war!" cried impetuous J.T. Maston.

"Hear, hear!" was heard on every side.

"But war," said Barbicane, "war is impossible under actual circumstances, and, whatever my honourable interrupter may hope, long years will elapse before our cannons thunder on a field of battle. We must, therefore, make up our minds to it, and seek in another order of ideas food for the activity by which we are devoured."

The assembly felt that its president was coming to the delicate point; it redoubled its attention.

"A few months ago, my brave colleagues," continued Barbicane, "I asked myself if, whilst still remaining in our speciality, we could not undertake some grand experiment worthy of the nineteenth century, and if the progress of ballistics would not allow us to execute it with success. I have therefore sought, worked, calculated, and the conviction has resulted from my studies that we must succeed in an enterprise that would seem impracticable in any other country. This project, elaborated at length, will form the subject of my communication; it is worthy of you, worthy of the Gun Club's past history, and cannot fail to make a noise in the world!"

"Much noise?" cried a passionate artilleryman.

"Much noise in the true sense of the word," answered Barbicane.

“Don’t interrupt!” repeated several voices.

“I therefore beg of you, my brave colleagues,” resumed the president, “to grant me all your attention.”

A shudder ran through the assembly. Barbicane, having with a rapid gesture firmly fixed his hat on his head, continued his speech in a calm tone:—

“There is not one of you, brave colleagues, who has not seen the moon, or, at least, heard of It. Do not be astonished if I wish to speak to you about the Queen of Night. It is, perhaps, our lot to be the Columbuses of this unknown world. Understand me, and second me as much as you can, I will lead you to its conquest, and its name shall be joined to those of the thirty-six States that form the grand country of the Union!”

“Hurrah for the moon!” cried the Gun Club with one voice.

“The moon has been much studied,” resumed Barbicane; “its mass, density, weight, volume, constitution, movements, distance, the part it plays in the solar world, are all perfectly determined; selenographic maps have been drawn with a perfection that equals, if it does not surpass, those of terrestrial maps; photography has given to our satellite proofs of incomparable beauty—in a word, all that the sciences of mathematics, astronomy, geology, and optics can teach is known about the moon; but until now no direct communication with it has ever been established.”

A violent movement of interest and surprise welcomed this sentence of the orator.

“Allow me,” he resumed, “to recall to you in few words how certain ardent minds, embarked upon imaginary journeys, pretended to have penetrated the secrets of our satellite. In the seventeenth century a certain David Fabricius boasted of having seen the inhabitants of the moon with his own eyes. In 1649 a Frenchman, Jean Baudoin, published his *Journey to the Moon by Dominique Gonzales, Spanish Adventurer*. At the same epoch Cyrano de Bergerac published the celebrated expedition that had so much success in France. Later on, another Frenchman (that nation took a great deal of notice of the moon), named Fontenelle, wrote his *Plurality of Worlds*, a masterpiece of his time; but science in its progress crushes even masterpieces! About 1835, a pamphlet, translated from the *New York American*, related that Sir John Herschel, sent to the Cape of Good Hope, there to make astronomical observations, had, by means of a telescope, perfected by interior lighting, brought the moon to within a distance of eighty yards. Then he distinctly perceived caverns in which lived hippopotami, green mountains with golden borders, sheep with ivory horns, white deer, and inhabitants with membraneous wings like those of bats. This treatise, the work of an American named Locke, had a very great success. But it was soon found out that it was a scientific mystification, and Frenchmen were the first to laugh at it.”

“Laugh at an American!” cried J.T. Maston; “but that’s a *casus belli*!”

“Be comforted, my worthy friend; before Frenchmen laughed they were completely taken in by our countryman. To terminate this rapid history, I may add that a certain Hans Pfaal, of Rotterdam, went up in a balloon filled with a gas made from azote, thirty-seven times lighter than hydrogen, and reached the moon after a journey of nineteen days. This journey, like the preceding attempts, was purely imaginary, but it was the work of a popular American writer of a strange and contemplative genius. I have named Edgar Poe!”

“Hurrah for Edgar Poe!” cried the assembly, electrified by the words of the president.

“I have now come to an end of these attempts which I may call purely literary, and quite insufficient to establish any serious communications with the Queen of Night. However, I

ought to add that some practical minds tried to put themselves into serious communication with her. Some years ago a German mathematician proposed to send a commission of *savants* to the steppes of Siberia. There, on the vast plains, immense geometrical figures were to be traced by means of luminous reflectors; amongst others, the square of the hypothenuse, vulgarly called the 'Ass's Bridge.' 'Any intelligent being,' said the mathematician, 'ought to understand the scientific destination of that figure. The Selenites (inhabitants of the moon), if they exist, will answer by a similar figure, and, communication once established, it will be easy to create an alphabet that will allow us to hold converse with the inhabitants of the moon.' Thus spoke the German mathematician, but his project was not put into execution, and until now no direct communication has existed between the earth and her satellite. But it was reserved to the practical genius of Americans to put itself into communication with the sidereal world. The means of doing so are simple, easy, certain, unfailing, and will make the subject of my proposition."

A hubbub and tempest of exclamations welcomed these words. There was not one of the audience who was not dominated and carried away by the words of the orator.

"Hear, hear! Silence!" was heard on all sides.

When the agitation was calmed down Barbicane resumed, in a graver tone, his interrupted speech.

"You know," said he, "what progress the science of ballistics has made during the last few years, and to what degree of perfection firearms would have been brought if the war had gone on. You are not ignorant in general that the power of resistance of cannons and the expansive force of powder are unlimited. Well, starting from that principle, I asked myself if, by means of sufficient apparatus, established under determined conditions of resistance, it would not be possible to send a cannon-ball to the moon!"

At these words an "Oh!" of stupefaction escaped from a thousand panting breasts; then occurred a moment of silence, like the profound calm that precedes thunder. In fact, the thunder came, but a thunder of applause, cries, and clamour which made the meeting-hall shake again. The president tried to speak; he could not. It was only at the end of ten minutes that he succeeded in making himself heard.

"Let me finish," he resumed coldly. "I have looked at the question in all its aspects, and from my indisputable calculations it results that any projectile, hurled at an initial speed of twelve thousand yards a second, and directed at the moon, must necessarily reach her. I have, therefore, the honour of proposing to you, my worthy colleagues, the attempting of this little experiment."

III. Effect Of President Barbicane's Communication

It is impossible to depict the effect produced by the last words of the honourable president. What cries! what vociferations! What a succession of groans, hurrahs, cheers, and all the onomatopoeia of which the American language is so full. It was an indescribable hubbub and disorder. Mouths, hands, and feet made as much noise as they could. All the weapons in this artillery museum going off at once would not have more violently agitated the waves of sound. That is not surprising; there are cannoneers nearly as noisy as their cannons.

Barbicane remained calm amidst these enthusiastic clamours; perhaps he again wished to address some words to his colleagues, for his gestures asked for silence, and his fulminating bell exhausted itself in violent detonations; it was not even heard. He was soon dragged from his chair, carried in triumph, and from the hands of his faithful comrades he passed into those of the no less excited crowd.

Nothing can astonish an American. It has often been repeated that the word "impossible" is not French; the wrong dictionary must have been taken by mistake. In America everything is easy, everything is simple, and as to mechanical difficulties, they are dead before they are born. Between the Barbicane project and its realisation not one true Yankee would have allowed himself to see even the appearance of a difficulty. As soon said as done.

The triumphant march of the president was prolonged during the evening. A veritable torchlight procession—Irish, Germans, Frenchmen, Scotchmen—all the heterogeneous individuals that compose the population of Maryland—shouted in their maternal tongue, and the cheering was unanimous.

Precisely as if she knew it was all about her, the moon shone out then with serene magnificence, eclipsing other lights with her intense irradiation. All the Yankees directed their eyes towards the shining disc; some saluted her with their hands, others called her by the sweetest names; between eight o'clock and midnight an optician in Jones-Fall-street made a fortune by selling field-glasses. The Queen of Night was looked at through them like a lady of high life. The Americans acted in regard to her with the freedom of proprietors. It seemed as if the blonde Phoebe belonged to these enterprising conquerors and already formed part of the Union territory. And yet the only question was that of sending a projectile—a rather brutal way of entering into communication even with a satellite, but much in vogue amongst civilised nations.

Midnight had just struck, and the enthusiasm did not diminish; it was kept up in equal doses in all classes of the population; magistrates, *savants*, merchants, tradesmen, street-porters, intelligent as well as "green" men were moved even in their most delicate fibres. It was a national enterprise; the high town, low town, the quays bathed by the waters of the Patapsco, the ships, imprisoned in their docks, overflowed with crowds intoxicated with joy, gin, and whisky; everybody talked, argued, perorated, disputed, approved, and applauded, from the gentleman comfortably stretched on the bar-room couch before his glass of "sherry-cobbler" to the waterman who got drunk upon "knock-me-down" in the dark taverns of Fell's Point.

However, about 2 a.m. the emotion became calmer. President Barbicane succeeded in getting home almost knocked to pieces. A Hercules could not have resisted such enthusiasm. The crowd gradually abandoned the squares and streets. The four railroads of Ohio, Susquehanna,

Philadelphia, and Washington, which converge at Baltimore, took the heterogeneous population to the four corners of the United States, and the town reposed in a relative tranquillity.

It would be an error to believe that during this memorable evening Baltimore alone was agitated. The large towns of the Union, New York, Boston, Albany, Washington, Richmond, New Orleans, Charlestown, La Mobile of Texas, Massachusetts, Michigan, and Florida, all shared in the delirium. The thirty thousand correspondents of the Gun Club were acquainted with their president's letter, and awaited with equal impatience the famous communication of the 5th of October. The same evening as the orator uttered his speech it ran along the telegraph wires, across the states of the Union, with a speed of 348,447 miles a second. It may, therefore, be said with absolute certainty that at the same moment the United States of America, ten times as large as France, cheered with a single voice, and twenty-five millions of hearts, swollen with pride, beat with the same pulsation.

The next day five hundred daily, weekly, monthly, or bi-monthly newspapers took up the question; they examined it under its different aspects—physical, meteorological, economical, or moral, from a political or social point of view. They debated whether the moon was a finished world, or if she was not still undergoing transformation. Did she resemble the earth in the time when the atmosphere did not yet exist? What kind of spectacle would her hidden hemisphere present to our terrestrial spheroid? Granting that the question at present was simply about sending a projectile to the Queen of Night, every one saw in that the starting-point of a series of experiments; all hoped that one day America would penetrate the last secrets of the mysterious orb, and some even seemed to fear that her conquest would disturb the balance of power in Europe.

The project once under discussion, not one of the papers suggested a doubt of its realisation; all the papers, treatises, bulletins, and magazines published by scientific, literary, or religious societies enlarged upon its advantages, and the "Natural History Society" of Boston, the "Science and Art Society" of Albany, the "Geographical and Statistical Society" of New York, the "American Philosophical Society" of Philadelphia, and the "Smithsonian Institution" of Washington sent in a thousand letters their congratulations to the Gun Club, with immediate offers of service and money.

It may be said that no proposition ever had so many adherents; there was no question of hesitations, doubts, or anxieties. As to the jokes, caricatures, and comic songs that would have welcomed in Europe, and, above all, in France, the idea of sending a projectile to the moon, they would have been turned against their author; all the "life-preservers" in the world would have been powerless to guarantee him against the general indignation. There are things that are not to be laughed at in the New World.

Impey Barbicane became from that day one of the greatest citizens of the United States, something like a Washington of science, and one fact amongst several will serve to show the sudden homage which was paid by a nation to one man.

Some days after the famous meeting of the Gun Club the manager of an English company announced at the Baltimore Theatre a representation of *Much Ado About Nothing*, but the population of the town, seeing in the title a damaging allusion to the projects of President Barbicane, invaded the theatre, broke the seats, and forced the unfortunate manager to change the play. Like a sensible man, the manager, bowing to public opinion, replaced the offending comedy by *As You Like It*, and for several weeks he had fabulous houses.

IV. Answer From The Cambridge Observatory

In the meantime Barbicane did not lose an instant amidst the enthusiasm of which he was the object. His first care was to call together his colleagues in the board-room of the Gun Club. There, after a debate, they agreed to consult astronomers about the astronomical part of their enterprise. Their answer once known, they would then discuss the mechanical means, and nothing would be neglected to assure the success of their great experiment.

A note in precise terms, containing special questions, was drawn up and addressed to the observatory of Cambridge in Massachusetts. This town, where the first University of the United States was founded, is justly celebrated for its astronomical staff. There are assembled the greatest men of science; there is the powerful telescope which enabled Bond to resolve the nebula of Andromeda and Clarke to discover the satellite of Sirius. This celebrated institution was, therefore, worthy in every way of the confidence of the Gun Club.

After two days the answer, impatiently awaited, reached the hands of President Barbicane.

It ran as follows:—

"*The Director of the Cambridge Observatory to the President of the Gun Club at Baltimore*.

"On the receipt of your favour of the 6th inst., addressed to the Observatory of Cambridge in the name of the members of the Baltimore Gun Club, we immediately called a meeting of our staff, who have deemed it expedient to answer as follows:—

"The questions proposed to it were these:—

"'1. Is it possible to send a projectile to the moon?

"'2. What is the exact distance that separates the earth and her satellite?

"'3. What would be the duration of the projectile's transit to which a sufficient initial speed had been given, and consequently at what moment should it be hurled so as to reach the moon at a particular point?

"'4. At what moment would the moon present the most favourable position for being reached by the projectile?

"'5. What point in the heavens ought the cannon, destined to hurl the projectile, be aimed at?

"'6. What place in the heavens will the moon occupy at the moment when the projectile will start?'

"Regarding question No. 1, 'Is it possible to send a projectile to the moon?'

"Yes, it is possible to send a projectile to the moon if it is given an initial velocity of 1,200 yards a second. Calculations prove that this speed is sufficient. In proportion to the distance from the earth the force of gravitation diminishes in an inverse ratio to the square of the distance—that is to say, that for a distance three times greater that force is nine times less. In consequence, the weight of the projectile will decrease rapidly, and will end by being completely annulled at the moment when the attraction of the moon will be equal to that of the earth—that is to say, at the 47/52 of the distance. At that moment the projectile will have no weight at all, and if it clears that point it will fall on to the moon only by the effect of lunar gravitation. The theoretic possibility of the experiment is, therefore, quite demonstrated; as to its success, that depends solely in the power of the engine employed.

“Regarding question No. 2, ‘What is the exact distance that separates the earth from her satellite?’

“The moon does not describe a circle round the earth, but an ellipse, of which our earth occupies one of the foci; the consequence is, therefore, that at certain times it approaches nearer to, and at others recedes farther from, the earth, or, in astronomical language, it has its apogee and its perigee. At its apogee the moon is at 247,552 miles from the earth, and at its perigee at 218,657 miles only, which makes a difference of 28,895, or more than a ninth of the distance. The perigee distance is, therefore, the one that should give us the basis of all calculations.

“Regarding question No. 3, ‘What would be the duration of the projectile’s transit to which a sufficient initial speed has been given, and consequently at what moment should it be hurled so as to reach the moon at a particular point?’

“If the projectile kept indefinitely the initial speed of 12,000 yards a second, it would only take about nine hours to reach its destination; but as that initial velocity will go on decreasing, it will happen, everything calculated upon, that the projectile will take 300,000 seconds, or 83 hours and 20 minutes, to reach the point where the terrestrial and lunar gravitations are equal, and from that point it will fall upon the moon in 50,000 seconds, or 13 hours, 53 minutes, and 20 seconds. It must, therefore, be hurled 97 hours, 13 minutes, and 20 seconds before the arrival of the moon at the point aimed at.

“Regarding question No. 4, ‘At what moment would the moon present the most favourable position for being reached by the projectile?’

“According to what has been said above the epoch of the moon’s perigee must first be chosen, and at the moment when she will be crossing her zenith, which will still further diminish the entire distance by a length equal to the terrestrial radius—i.e., 3,919 miles; consequently, the passage to be accomplished will be 214,976 miles. But the moon is not always at her zenith when she reaches her perigee, which is once a month. She is only under the two conditions simultaneously at long intervals of time. This coincidence of perigee and zenith must be waited for. It happens fortunately that on December 4th of next year the moon will offer these two conditions; at midnight she will be at her perigee and her zenith—that is to say, at her shortest distance from the earth and at her zenith at the same time.

“Regarding question No. 5, ‘At what point in the heavens ought the cannon destined to hurl the projectile be aimed?’

“The preceding observations being admitted, the cannon ought to be aimed at the zenith of the place (the zenith is the spot situated vertically above the head of a spectator), so that its range will be perpendicular to the plane of the horizon, and the projectile will pass the soonest beyond the range of terrestrial gravitation. But for the moon to reach the zenith of a place that place must not exceed in latitude the declination of the luminary—in other words, it must be comprised between 0° and 28° of north or south latitude. In any other place the range must necessarily be oblique, which would seriously affect the success of the experiment.

“Regarding question No. 6, ‘What place will the moon occupy In the heavens at the moment of the projectile’s departure?’

“At the moment when the projectile is hurled into space, the moon, which travels forward 13° 10’ 35” each day, will be four times as distant from her zenith point—i.e., by 52° 42’ 20”, a space which corresponds to the distance she will travel during the transit of the projectile. But as the deviation which the rotatory movement of the earth will impart to the shock must also

be taken into account, and as the projectile cannot reach the moon until after a deviation equal to sixteen radii of the earth, which, calculated upon the moon's orbit, is equal to about 11°, it is necessary to add these 11° to those caused by the already-mentioned delay of the moon, or, in round numbers, 64°. Thus, at the moment of firing, the visual radius applied to the moon will describe with the vertical line of the place an angle of 64°.

"Such are the answers to the questions proposed to the Observatory of Cambridge by the members of the Gun Club.

"To sum up—

"1st. The cannon must be placed in a country situated between 0° and 28° of north or south latitude.

"2nd. It must be aimed at the zenith of the place.

"3rd. The projectile must have an initial speed of 12,000 yards a second.

"4th. It must be hurled on December 1st of next year, at 10hrs. 46mins. 40secs. p.m.

"5th. It will meet the moon four days after its departure on December 4th, at midnight precisely, at the moment she arrives at her zenith.

"The members of the Gun Club ought, therefore, at once to commence the labour necessitated by such an enterprise, and be ready to put them into execution at the moment fixed upon, for they will not find the moon in the same conditions of perigee and zenith till eighteen years and eleven days later.

"The staff of the Observatory of Cambridge puts itself entirely at their disposition for questions of theoretic astronomy, and begs to join its congratulations to those of the whole of America.

"On behalf of the staff,

"J.M. BELFAST,

"*Director of the Observatory of Cambridge*."

V. The Romance Of The Moon

A spectator endowed with infinite power of sight, and placed at the unknown centre round which gravitates the universe, would have seen myriads of atoms filling all space during the chaotic epoch of creation. But by degrees, as centuries went on, a change took place; a law of gravitation manifested itself which the wandering atoms obeyed; these atoms, combined chemically according to their affinities, formed themselves into molecules, and made those nebulous masses with which the depths of the heavens are strewed.

These masses were immediately animated by a movement of rotation round their central point. This centre, made of vague molecules, began to turn on itself whilst progressively condensing; then, following the immutable laws of mechanics, in proportion as its volume became diminished by condensation its movement of rotation was accelerated, and these two effects persisting, there resulted a principal planet, the centre of the nebulous mass.

By watching attentively the spectator would then have seen other molecules in the mass behave like the central planet, and condense in the same manner by a movement of progressively-accelerated rotation, and gravitate round it under the form of innumerable stars. The nebulae, of which astronomers count nearly 5,000 at present, were formed.

Amongst these 5,000 nebulae there is one that men have called the Milky Way, and which contains eighteen millions of stars, each of which has become the centre of a solar world.

If the spectator had then specially examined amongst these eighteen millions of stars one of the most modest and least brilliant, a star of the fourth order, the one that proudly named itself the sun, all the phenomena to which the formation of the universe is due would have successively taken place under his eyes.

In fact, he would have perceived this sun still in its gaseous state, and composed of mobile molecules; he would have perceived it turning on its own axis to finish its work of concentration. This movement, faithful to the laws of mechanics, would have been accelerated by the diminution of volume, and a time would have come when the centrifugal force would have overpowered the centripetal, which causes the molecules all to tend towards the centre.

Then another phenomenon would have passed before the eyes of the spectator, and the molecules situated in the plane of the equator would have formed several concentric rings like that of Saturn round the sun. In their turn these rings of cosmic matter, seized with a movement of rotation round the central mass, would have been broken up into secondary nebulae—that is to say, into planets.

If the spectator had then concentrated all his attention on these planets he would have seen them behave exactly like the sun and give birth to one or more cosmic rings, origin of those secondary bodies which we call satellites.

Thus in going up from the atom to the molecule, from the molecule to the nebulae, and from the nebulae to the principal star, from the principal star to the sun, from the sun to the planet, and from the planet to the satellite, we have the whole series of transformations undergone by the celestial powers from the first days of the universe.

The sun seems lost amidst the immensities of the stellar universe, and yet it is related, by actual theories of science, to the nebula of the Milky Way. Centre of a world, and small as it appears amidst the ethereal regions, it is still enormous, for its size is 1,400,000 times that of

the earth. Around it gravitate eight planets, struck off from its own mass in the first days of creation. These are, in proceeding from the nearest to the most distant, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Between Mars and Jupiter circulate regularly other smaller bodies, the wandering *débris*, perhaps, of a star broken up into thousands of pieces, of which the telescope has discovered eighty-two at present. Some of these asteroids are so small that they could be walked round in a single day by going at a gymnastic pace.

Of these attendant bodies which the sun maintains in their elliptical orbit by the great law of gravitation, some possess satellites of their own. Uranus has eight, Saturn eight, Jupiter four, Neptune three perhaps, and the Earth one; this latter, one of the least important of the solar world, is called the Moon, and it is that one that the enterprising genius of the Americans means to conquer.

The Queen of Night, from her relative proximity and the spectacle rapidly renewed of her different phases, at first divided the attention of the inhabitants of the earth with the sun; but the sun tires the eyesight, and the splendour of its light forces its admirers to lower their eyes.

The blonde Phoebe, more humane, graciously allows herself to be seen in her modest grace; she is gentle to the eye, not ambitious, and yet she sometimes eclipses her brother the radiant Apollo, without ever being eclipsed by him. The Mahommedans understood what gratitude they owed to this faithful friend of the earth, and they ruled their months at 29-1/2 days on her revolution.

The first people of the world dedicated particular worship to this chaste goddess. The Egyptians called her Isis, the Phoenicians Astarte, the Greeks Phoebe, daughter of Jupiter and Latona, and they explained her eclipses by the mysterious visits of Diana and the handsome Endymion. The mythological legend relates that the Nemean lion traversed the country of the moon before its apparition upon earth, and the poet Agesianax, quoted by Plutarch, celebrated in his sweet lines its soft eyes, charming nose, and admirable mouth, formed by the luminous parts of the adorable Selene.

But though the ancients understood the character, temperament, and, in a word, moral qualities of the moon from a mythological point of view, the most learned amongst them remained very ignorant of selenography.

Several astronomers, however, of ancient times discovered certain particulars now confirmed by science. Though the Arcadians pretended they had inhabited the earth at an epoch before the moon existed, though Simplicius believed her immovable and fastened to the crystal vault, though Tacitus looked upon her as a fragment broken off from the solar orbit, and Clearch, the disciple of Aristotle, made of her a polished mirror upon which were reflected the images of the ocean—though, in short, others only saw in her a mass of vapours exhaled by the earth, or a globe half fire and half ice that turned on itself, other *savants*, by means of wise observations and without optical instruments, suspected most of the laws that govern the Queen of Night.

Thus Thales of Miletus, B.C. 460, gave out the opinion that the moon was lighted up by the sun. Aristarchus of Samos gave the right explanation of her phases. Cleomenus taught that she shone by reflected light. Berose the Chaldean discovered that the duration of her movement of rotation was equal to that of her movement of revolution, and he thus explained why the moon always presented the same side. Lastly, Hipparchus, 200 years before the Christian era, discovered some inequalities in the apparent movements of the earth’s satellite.

These different observations were afterwards confirmed, and other astronomers profited by them. Ptolemy in the second century, and the Arabian Aboul Wefa in the tenth, completed the

remarks of Hipparchus on the inequalities that the moon undergoes whilst following the undulating line of its orbit under the action of the sun. Then Copernicus, in the fifteenth century, and Tycho Brahe, in the sixteenth, completely exposed the system of the world and the part that the moon plays amongst the celestial bodies.

At that epoch her movements were pretty well known, but very little of her physical constitution was known. It was then that Galileo explained the phenomena of light produced in certain phases by the existence of mountains, to which he gave an average height of 27,000 feet.

After him, Hevelius, an astronomer of Dantzig, lowered the highest altitudes to 15,000 feet; but his contemporary, Riccioli, brought them up again to 21,000 feet.

Herschel, at the end of the eighteenth century, armed with a powerful telescope, considerably reduced the preceding measurements. He gave a height of 11,400 feet to the highest mountains, and brought down the average of different heights to little more than 2,400 feet. But Herschel was mistaken too, and the observations of Schroeter, Louville, Halley, Nasmyth, Bianchini, Pastorff, Lohrman, Gruithuysen, and especially the patient studies of MM. Boeer and Moedler, were necessary to definitely resolve the question. Thanks to these *savants*, the elevation of the mountains of the moon is now perfectly known. Boeer and Moedler measured 1,905 different elevations, of which six exceed 15,000 feet and twenty-two exceed 14,400 feet. Their highest summit towers to a height of 22,606 feet above the surface of the lunar disc.

At the same time the survey of the moon was being completed; she appeared riddled with craters, and her essentially volcanic nature was affirmed by each observation. From the absence of refraction in the rays of the planets occulted by her it is concluded that she can have no atmosphere. This absence of air entails absence of water; it therefore became manifest that the Selenites, in order to live under such conditions, must have a special organisation, and differ singularly from the inhabitants of the earth.

Lastly, thanks to new methods, more perfected instruments searched the moon without intermission, leaving not a point of her surface unexplored, and yet her diameter measures 2,150 miles; her surface is one-thirteenth of the surface of the globe, and her volume one-forty-ninth of the volume of the terrestrial spheroid; but none of her secrets could escape the astronomers' eyes, and these clever *savants* carried their wonderful observations still further.

Thus they remarked that when the moon was at her full the disc appeared in certain places striped with white lines, and during her phases striped with black lines. By prosecuting the study of these with greater precision they succeeded in making out the exact nature of these lines. They are long and narrow furrows sunk between parallel ridges, bordering generally upon the edges of the craters; their length varied from ten to one hundred miles, and their width was about 1,600 yards. Astronomers called them furrows, and that was all they could do; they could not ascertain whether they were the dried-up beds of ancient rivers or not. The Americans hope, some day or other, to determine this geological question. They also undertake to reconnoitre the series of parallel ramparts discovered on the surface of the moon by Gruithuysen, a learned professor of Munich, who considered them to be a system of elevated fortifications raised by Selenite engineers. These two still obscure points, and doubtless many others, can only be definitely settled by direct communication with the moon.

As to the intensity of her light there is nothing more to be learnt; it is 300,000 times weaker than that of the sun, and its heat has no appreciable action upon thermometers; as to the phenomenon known as the "ashy light," it is naturally explained by the effect of the sun's

rays transmitted from the earth to the moon, and which seem to complete the lunar disc when it presents a crescent form during its first and last phases.

Such was the state of knowledge acquired respecting the earth's satellite which the Gun Club undertook to perfect under all its aspects, cosmographical, geographical, geological, political, and moral.

VI. What It Is Impossible To Ignore And What Is No Longer Allowed To Be Believed In The United States

The immediate effect of Barbicane's proposition was that of bringing out all astronomical facts relative to the Queen of Night. Everybody began to study her assiduously. It seemed as if the moon had appeared on the horizon for the first time, and that no one had ever seen her in the sky before. She became the fashion; she was the lion of the day, without appearing less modest on that account, and took her place amongst the "stars" without being any the prouder. The newspapers revived old anecdotes in which this "Sun of the wolves" played a part; they recalled the influence which the ignorance of past ages had ascribed to her; they sang about her in every tone; a little more and they would have quoted her witty sayings; the whole of America was filled with selenomania.

The scientific journals treated the question which touched upon the enterprise of the Gun Club more specially; they published the letter from the Observatory of Cambridge, they commented upon it and approved of it without reserve.

In short, even the most ignorant Yankee was no longer allowed to be ignorant of a single fact relative to his satellite, nor, to the oldest women amongst them, to have any superstitions about her left. Science flooded them; it penetrated into their eyes and ears; it was impossible to be an ass—in astronomy.

Until then many people did not know how the distance between the earth and the moon had been calculated. This fact was taken advantage of to explain to them that it was done by measuring the parallax of the moon. If the word "parallax" seemed new to them, they were told it was the angle formed by two straight lines drawn from either extremity of the earth's radius to the moon. If they were in doubt about the perfection of this method, it was immediately proved to them that not only was the mean distance 234,347 miles, but that astronomers were right to within seventy miles.

To those who were not familiar with the movements of the moon, the newspapers demonstrated daily that she possesses two distinct movements, the first being that of rotation upon her axis, the second that of revolution round the earth, accomplishing both in the same time—that is to say, in 27-1/3 days.

The movement of rotation is the one that causes night and day on the surface of the moon, only there is but one day and one night in a lunar month, and they each last 354-1/3 hours. But, happily, the face, turned towards the terrestrial globe, is lighted by it with an intensity equal to the light of fourteen moons. As to the other face, the one always invisible, it has naturally 354 hours of absolute night, tempered only by "the pale light that falls from the stars." This phenomenon is due solely to the peculiarity that the movements of rotation and revolution are accomplished in rigorously equal periods, a phenomenon which, according to Cassini and Herschel, is common to the satellites of Jupiter, and, very probably to the other satellites.

Some well-disposed but rather unyielding minds did not quite understand at first how, if the moon invariably shows the same face to the earth during her revolution, she describes one turn round herself in the same period of time. To such it was answered—"Go into your dining-room, and turn round the table so as always to keep your face towards the centre;

when your circular walk is ended you will have described one circle round yourselves, since your eye will have successively traversed every point of the room. Well, then, the room is the heavens, the table is the earth, and you are the moon!”

And they go away delighted with the comparison.

Thus, then, the moon always presents the same face to the earth; still, to be quite exact, it should be added that in consequence of certain fluctuations from north to south and from west to east, called libration, she shows rather more than the half of her disc, about 0.57.

When the ignoramuses knew as much as the director of the Cambridge Observatory about the moon’s movement of rotation they began to make themselves uneasy about her movement of revolution round the earth, and twenty scientific reviews quickly gave them the information they wanted. They then learnt that the firmament, with its infinite stars, may be looked upon as a vast dial upon which the moon moves, indicating the time to all the inhabitants of the earth; that it is in this movement that the Queen of Night shows herself in her different phases, that she is full when she is in opposition with the sun—that is to say, when the three bodies are on a line with each other, the earth being in the centre; that the moon is new when she is in conjunction with the sun—that is to say, when she is between the sun and the earth; lastly, that the moon is in her first or last quarter when she makes, with the sun and the earth, a right angle of which she occupies the apex.

Some perspicacious Yankees inferred in consequence that eclipses could only take place at the periods of conjunction or opposition, and their reasoning was just. In conjunction the moon can eclipse the sun, whilst in opposition it is the earth that can eclipse him in her turn; and the reason these eclipses do not happen twice in a lunar month is because the plane upon which the moon moves is elliptical like that of the earth.

As to the height which the Queen of Night can attain above the horizon, the letter from the Observatory of Cambridge contained all that can be said about it. Every one knew that this height varies according to the latitude of the place where the observation is taken. But the only zones of the globe where the moon reaches her zenith—that is to say, where she is directly above the heads of the spectators—are necessarily comprised between the 28th parallels and the equator. Hence the important recommendation given to attempt the experiment upon some point in this part of the globe, in order that the projectile may be hurled perpendicularly, and may thus more quickly escape the attraction of gravitation. This was a condition essential to the success of the enterprise, and public opinion was much exercised thereupon.

As to the line followed by the moon in her revolution round the earth, the Observatory of Cambridge had demonstrated to the most ignorant that it is an ellipse of which the earth occupies one of the foci. These elliptical orbits are common to all the planets as well as to all the satellites, and rational mechanism rigorously proves that it could not be otherwise. It was clearly understood that when at her apogee the moon was farthest from the earth, and when at her perigee she was nearest to our planet.

This, therefore, was what every American knew whether he wished to or no, and what no one could decently be ignorant of. But if these true principles rapidly made their way, certain illusive fears and many errors were with difficulty cleared away.

Some worthy people maintained, for instance, that the moon was an ancient comet, which, whilst travelling along its elongated orbit round the sun, passed near to the earth, and was retained in her circle of attraction. The drawing-room astronomers pretended to explain thus the burnt aspect of the moon, a misfortune of which they accused the sun. Only when they

were told to notice that comets have an atmosphere, and that the moon has little or none, they did not know what to answer.

Others belonging to the class of “Shakers” manifested certain fears about the moon; they had heard that since the observations made in the times of the Caliphs her movement of revolution had accelerated in a certain proportion; they thence very logically concluded that an acceleration of movement must correspond to a diminution in the distance between the two bodies, and that this double effect going on infinitely the moon would one day end by falling into the earth. However, they were obliged to reassure themselves and cease to fear for future generations when they were told that according to the calculations of Laplace, an illustrious French mathematician, this acceleration of movement was restricted within very narrow limits, and that a proportional diminution will follow it. Thus the equilibrium of the solar world cannot be disturbed in future centuries.

Lastly there was the superstitious class of ignoramuses to be dealt with; these are not content with being ignorant; they know what does not exist, and about the moon they know a great deal. Some of them considered her disc to be a polished mirror by means of which people might see themselves from different points on the earth, and communicate their thoughts to one another. Others pretended that out of 1,000 new moons 950 had brought some notable change, such as cataclysms, revolutions, earthquakes, deluges, &c.; they therefore believed in the mysterious influence of the Queen of Night on human destinies; they think that every Selenite is connected by some sympathetic tie with each inhabitant of the earth; they pretend, with Dr. Mead, that she entirely governs the vital system—that boys are born during the new moon and girls during her last quarter, &c., &c. But at last it became necessary to give up these vulgar errors, to come back to truth; and if the moon, stripped of her influence, lost her prestige in the minds of courtesans of every power, if some turned their backs on her, the immense majority were in her favour. As to the Yankees, they had no other ambition than that of taking possession of this new continent of the sky, and to plant upon its highest summit the star-spangled banner of the United States of America.

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!”

VIII. History Of The Cannon

The resolutions passed at this meeting produced a great effect outside. Some timid people grew alarmed at the idea of a projectile weighing 20,000 lbs. hurled into space. People asked what cannon could ever transmit an initial speed sufficient for such a mass. The report of the second meeting was destined to answer these questions victoriously.

The next evening the four members of the Gun Club sat down before fresh mountains of sandwiches and a veritable ocean of tea. The debate then began.

“My dear colleagues,” said Barbicane, “we are going to occupy ourselves with the construction of the engine, its length, form, composition, and weight. It is probable that we shall have to give it gigantic dimensions, but, however great our difficulties might be, our industrial genius will easily overcome them. Will you please listen to me and spare objections for the present? I do not fear them.”

An approving murmur greeted this declaration.

“We must not forget,” resumed Barbicane, “to what point our yesterday’s debate brought us; the problem is now the following: how to give an initial speed of 12,000 yards a second to a shot 108 inches in diameter weighing 20,000 lbs.

“That is the problem indeed,” answered Major Elphinstone.

“When a projectile is hurled into space,” resumed Barbicane, “what happens? It is acted upon by three independent forces, the resistance of the medium, the attraction of the earth, and the force of impulsion with which it is animated. Let us examine these three forces. The resistance of the medium—that is to say, the resistance of the air—is of little importance. In fact, the terrestrial atmosphere is only forty miles deep. With a rapidity of 12,000 yards the projectile will cross that in five seconds, and this time will be short enough to make the resistance of the medium insignificant. Let us now pass to the attraction of the earth—that is to say, to the weight of the projectile. We know that that weight diminishes in an inverse ratio to the square of distances—in fact, this is what physics teach us: when a body left to itself falls on the surface of the earth, it falls 15 feet in the first second, and if the same body had to fall 257,542 miles—that is to say, the distance between the earth and the moon—its fall would be reduced to half a line in the first second. That is almost equivalent to immobility. The question is, therefore, how progressively to overcome this law of gravitation. How shall we do it? By the force of impulsion?”

“That is the difficulty,” answered the major.

“That is it indeed,” replied the president. “But we shall triumph over it, for this force of impulsion we want depends on the length of the engine and the quantity of powder employed, the one only being limited by the resistance of the other. Let us occupy ourselves, therefore, to-day with the dimensions to be given to the cannon. It is quite understood that we can make it, as large as we like, seeing it will not have to be moved.”

“All that is evident,” replied the general.

“Until now,” said Barbicane, “the longest cannon, our enormous Columbiads, have not been more than twenty-five feet long; we shall therefore astonish many people by the dimensions we shall have to adopt.”

“Certainly,” exclaimed J.T. Maston. “For my part, I ask for a cannon half a mile long at least!”

“Half a mile!” cried the major and the general.

“Yes, half a mile, and that will be half too short.”

“Come, Maston,” answered Morgan, “you exaggerate.”

“No, I do not,” said the irate secretary; “and I really do not know why you tax me with exaggeration.”

“Because you go too far.”

“You must know, sir,” answered J.T. Maston, looking dignified, “that an artilleryman is like a cannon-ball, he can never go too far.”

The debate was getting personal, but the president interfered.

“Be calm, my friends, and let us reason it out. We evidently want a gun of great range, as the length of the engine will increase the detention of gas accumulated behind the projectile, but it is useless to overstep certain limits.”

“Perfectly,” said the major.

“What are the usual rules in such a case? Ordinarily the length of a cannon is twenty or twenty-five times the diameter of the projectile, and it weighs 235 to 240 times its weight.”

“It is not enough,” cried J.T. Maston with impetuosity.

“I agree to that, my worthy friend, and in fact by keeping that proportion for a projectile nine feet wide, weighing 30,000 lbs., the engine would only have a length of 225 feet and a weight of 7,200,000 lbs.”

“That is ridiculous,” resumed J.T. Maston. “You might as well take a pistol.”

“I think so too,” answered Barbicane; “that is why I propose to quadruple that length, and to construct a cannon 900 feet long.”

The general and the major made some objections, but, nevertheless, this proposition, strongly supported by the secretary, was definitely adopted.

“Now,” said Elphinstone, “what thickness must we give its sides?”

“A thickness of six feet,” answered Barbicane.

“You do not think of raising such a mass upon a gun-carriage?” asked the major.

“That would be superb, however! said J.T. Maston.

“But impracticable,” answered Barbicane. “No, I think of casting this engine in the ground itself, binding it up with wrought-iron hoops, and then surrounding it with a thick mass of stone and cement masonry. When it is cast it must be bored with great precision so as to prevent windage, so there will be no loss of gas, and all the expansive force of the powder will be employed in the propulsion.”

“Hurrah! hurrah!” said Maston, “we have our cannon.”

“Not yet,” answered Barbicane, calming his impatient friend with his hand.

“Why not?”

“Because we have not discussed its form. Shall it be a cannon, howitzer, or a mortar?”

“A cannon,” replied Morgan.

“A howitzer,” said the major.

“A mortar,” exclaimed J.T. Maston.

A fresh discussion was pending, each taking the part of his favourite weapon, when the president stopped it short.

“My friends,” said he, “I will soon make you agree. Our Columbiad will be a mixture of all three. It will be a cannon, because the powder-magazine will have the same diameter as the chamber. It will be a howitzer, because it will hurl an obus. Lastly, it will be a mortar, because it will be pointed at an angle of 90°, and that without any chance of recoil; unalterably fixed to the ground, it will communicate to the projectile all the power of impulsion accumulated in its body.”

“Adopted, adopted,” answered the members of the committee.

“One question,” said Elphinstone, “and will this *canobusomortar* be rifled?”

“No,” answered Barbicane. “No, we must have an enormous initial speed, and you know very well that a shot leaves a rifle less rapidly than a smooth-bore.”

“True,” answered the major.

“Well, we have it this time,” repeated J.T. Maston.

“Not quite yet,” replied the president.

“Why not?”

“Because we do not yet know of what metal it will be made.”

“Let us decide that without delay.”

“I was going to propose it to you.”

The four members of the committee each swallowed a dozen sandwiches, followed by a cup of tea, and the debate recommenced.

“Our cannon,” said Barbicane, “must be possessed of great tenacity, great hardness; it must be infusible by heat, indissoluble, and inoxydable by the corrosive action of acids.”

“There is no doubt about that,” answered the major, “and as we shall have to employ a considerable quantity of metal we shall not have much choice.”

“Well, then,” said Morgan, “I propose for the fabrication of the Columbiad the best alloy hitherto known—that is to say, 100 parts of copper, 12 of tin, and 6 of brass.”

“My friends,” answered the president, “I agree that this composition has given excellent results; but in bulk it would be too dear and very hard to work. I therefore think we must adopt an excellent material, but cheap, such as cast-iron. Is not that your opinion, major?”

“Quite,” answered Elphinstone.

“In fact,” resumed Barbicane, “cast-iron costs ten times less than bronze; it is easily melted, it is readily run into sand moulds, and is rapidly manipulated; it is, therefore, an economy of money and time. Besides, that material is excellent, and I remember that during the war at the siege of Atlanta cast-iron cannon fired a thousand shots each every twenty minutes without being damaged by it.”

“Yet cast-iron is very brittle,” answered Morgan.

“Yes, but it possesses resistance too. Besides, we shall not let it explode, I can answer for that.”

“It is possible to explode and yet be honest,” replied J.T. Maston sententiously.

“Evidently,” answered Barbicane. “I am, therefore, going to beg our worthy secretary to calculate the weight of a cast-iron cannon 900 feet long, with an inner diameter of nine feet, and sides six feet thick.”

“At once,” answered J.T. Maston, and, as he had done the day before, he made his calculations with marvellous facility, and said at the end of a minute—

“This cannon will weigh 68,040 tons.”

“And how much will that cost at two cents a pound?”

“Two million five hundred and ten thousand seven hundred and one dollars.”

J.T. Maston, the major, and the general looked at Barbicane anxiously.

“Well, gentlemen,” said the president, “I can only repeat what I said to you yesterday, don’t be uneasy; we shall not want for money.”

Upon this assurance of its president the committee broke up, after having fixed a third meeting for the next evening.

IX. The Question Of Powders

The question of powder still remained to be settled. The public awaited this last decision with anxiety. The size of the projectile and length of the cannon being given, what would be the quantity of powder necessary to produce the impulsion? This terrible agent, of which, however, man has made himself master, was destined to play a part in unusual proportions.

It is generally known and often asserted that gunpowder was invented in the fourteenth century by the monk Schwartz, who paid for his great discovery with his life. But it is nearly proved now that this story must be ranked among the legends of the Middle Ages. Gunpowder was invented by no one; it is a direct product of Greek fire, composed, like it, of sulphur and saltpetre; only since that epoch these mixtures; which were only dissolving, have been transformed into detonating mixtures.

But if learned men know perfectly the false history of gunpowder, few people are aware of its mechanical power. Now this is necessary to be known in order to understand the importance of the question submitted to the committee.

Thus a litre of gunpowder weighs about 2 lbs.; it produces, by burning, about 400 litres of gas; this gas, liberated, and under the action of a temperature of 2,400°, occupies the space of 4,000 litres. Therefore the volume of powder is to the volume of gas produced by its deflagration as 1 to 400. The frightful force of this gas, when it is compressed into a space 4,000 times too small, may be imagined.

This is what the members of the committee knew perfectly when, the next day, they began their sitting. Major Elphinstone opened the debate.

“My dear comrades,” said the distinguished chemist, “I am going to begin with some unexceptionable figures, which will serve as a basis for our calculation. The 24-lb. cannon-ball, of which the Hon. J.T. Maston spoke the day before yesterday, is driven out of the cannon by 16 lbs. of powder only.”

“You are certain of your figures?” asked Barbicane.

“Absolutely certain,” answered the major. “The Armstrong cannon only uses 75 lbs. of powder for a projectile of 800 lbs., and the Rodman Columbiad only expends 160 lbs. of powder to send its half-ton bullet six miles. These facts cannot be doubted, for I found them myself in the reports of the Committee of Artillery.”

“That is certain,” answered the general.

“Well,” resumed the major, “the conclusion to be drawn from these figures is that the quantity of powder does not augment with the weight of the shot; in fact, if a shot of 24 lbs. took 16 lbs. of powder, and, in other terms, if in ordinary cannons a quantity of powder weighing two-thirds of the weight of the projectile is used, this proportion is not always necessary. Calculate, and you will see that for the shot of half a ton weight, instead of 333 lbs. of powder, this quantity has been reduced to 116 lbs. only.

“What are you driving at?” asked the president.

“The extreme of your theory, my dear major,” said J.T. Maston, “would bring you to having no powder at all, provided your shot were sufficiently heavy.”

“Friend Maston will have his joke even in the most serious things,” replied the major; “but he need not be uneasy; I shall soon propose a quantity of powder that will satisfy him. Only I

wish to have it understood that during the war, and for the largest guns, the weight of the powder was reduced, after experience, to a tenth of the weight of the shot."

"Nothing is more exact," said Morgan; "but, before deciding the quantity of powder necessary to give the impulsion, I think it would be well to agree upon its nature."

"We shall use a large-grained powder," answered the major; "its deflagration is the most rapid."

"No doubt," replied Morgan; "but it is very brittle, and ends by damaging the chamber of the gun."

"Certainly; but what would be bad for a gun destined for long service would not be so for our Columbiad. We run no danger of explosion, and the powder must immediately take fire to make its mechanical effect complete."

"We might make several touchholes," said J.T. Maston, "so as to set fire to it in several places at the same time."

"No doubt," answered Elphinstone, "but that would make the working of it more difficult. I therefore come back to my large-grained powder that removes these difficulties."

"So be it," answered the general.

"To load his Columbiad," resumed the major, "Rodman used a powder in grains as large as chestnuts, made of willow charcoal, simply rarefied in cast-iron pans. This powder was hard and shining, left no stain on the hands, contained a great proportion of hydrogen and oxygen, deflagrated instantaneously, and, though very brittle, did not much damage the mouthpiece."

"Well, it seems to me," answered J.T. Maston, "that we have nothing to hesitate about, and that our choice is made."

"Unless you prefer gold-powder," replied the major, laughing, which provoked a threatening gesture from the steel hook of his susceptible friend.

Until then Barbicane had kept himself aloof from the discussion; he listened, and had evidently an idea. He contented himself with saying simply—

"Now, my friends, what quantity of powder do you propose?"

The three members of the Gun Club looked at one another for the space of a minute.

"Two hundred thousand pounds," said Morgan at last.

"Five hundred thousand," replied the major.

"Eight hundred thousand," exclaimed J.T. Maston.

This, time Elphinstone dared not tax his colleague with exaggeration. In fact, the question was that of sending to the moon a projectile weighing 20,000 lbs., and of giving it an initial force of 2000 yards a second. A moment of silence, therefore, followed the triple proposition made by the three colleagues.

It was at last broken by President Barbicane.

"My brave comrades," said he in a quiet tone, "I start from this principle, that the resistance of our cannon, in the given conditions, is unlimited. I shall, therefore, surprise the Honourable J.T. Maston when I tell him that he has been timid in his calculations, and I propose to double his 800,000 lbs. of powder."

"Sixteen hundred thousand pounds!" shouted J.T. Maston, jumping out of his chair.

“Quite as much as that.”

“Then we shall have to come back to my cannon half a mile long.”

“It is evident,” said the major.

“Sixteen hundred thousand pounds of powder,” resumed the Secretary of Committee, “will occupy about a space of 22,000 cubic feet; now, as your cannon will only hold about 54,000 cubic feet, it will be half full, and the chamber will not be long enough to allow the explosion of the gas to give sufficient impulsion to your projectile.”

There was nothing to answer. J.T. Maston spoke the truth. They all looked at Barbicane.

“However,” resumed the president, “I hold to that quantity of powder. Think! 1,600,000 pounds of powder will give 6,000,000,000 litres of gas.”

“Then how is it to be done?” asked the general.

“It is very simple. We must reduce this enormous quantity of powder, keeping at the same time its mechanical power.”

“Good! By what means?”

“I will tell you,” answered Barbicane simply.

His interlocutors all looked at him.

“Nothing is easier, in fact,” he resumed, “than to bring that mass of powder to a volume four times less. You all know that curious cellular matter which constitutes the elementary tissues of vegetables?”

“Ah!” said the major, “I understand you, Barbicane.”

“This matter,” said the president, “is obtained in perfect purity in different things, especially in cotton, which is nothing but the skin of the seeds of the cotton plant. Now cotton, combined with cold nitric acid, is transformed into a substance eminently insoluble, eminently combustible, eminently explosive. Some years ago, in 1832, a French chemist, Braconnot, discovered this substance, which he called xyloidine. In 1838, another Frenchman, Pelouze, studied its different properties; and lastly, in 1846, Schonbein, professor of chemistry at Basle, proposed it as gunpowder. This powder is nitric cotton.”

“Or pyroxyle,” answered Elphinstone.

“Or fulminating cotton,” replied Morgan.

“Is there not an American name to put at the bottom of this discovery?” exclaimed J.T. Maston, animated by a lively sentiment of patriotism.

“Not one, unfortunately,” replied the major.

“Nevertheless, to satisfy Maston,” resumed the president, “I may tell him that one of our fellow-citizens may be annexed to the study of the celluosity, for collodion, which is one of the principal agents in photography, is simply pyroxyle dissolved in ether to which alcohol has been added, and it was discovered by Maynard, then a medical student.”

“Hurrah for Maynard and fulminating cotton!” cried the noisy secretary of the Gun Club.

“I return to pyroxyle,” resumed Barbicane. “You are acquainted with its properties which make it so precious to us. It is prepared with the greatest facility; cotton plunged in smoking nitric acid for fifteen minutes, then washed in water, then dried, and that is all.”

“Nothing is more simple, certainty,” said Morgan.

“What is more, pyroxyle is not damaged by moisture, a precious quality in our eyes, as it will take several days to load the cannon. Its inflammability takes place at 170° instead of at 240° and its deflagration is so immediate that it may be fired on ordinary gunpowder before the latter has time to catch fire too.”

“Perfect,” answered the major.

“Only it will cost more.”

“What does that matter?” said J.T. Maston.

“Lastly, it communicates to projectiles a speed four times greater than that of gunpowder. I may even add that if 8/10ths of its weight of nitrate of potash is added its expansive force is still greatly augmented.”

“Will that be necessary?” asked the major.

“I do not think so,” answered Barbicane. “Thus instead of 1,600,000 lbs. of powder, we shall only have 400,000 lbs. of fulminating cotton, and as we can, without danger, compress 500 lbs. of cotton into 27 cubic feet, that quantity will not take up more than 180 feet in the chamber of the Columbiad. By these means the projectile will have more than 700 feet of chamber to traverse under a force of 6,000,000,000 of litres of gas before taking its flight over the Queen of Night.”

Here J.T. Maston could not contain his emotion. He threw himself into the arms of his friend with the violence of a projectile, and he would have been stove in had he not have been bombproof.

This incident ended the first sitting of the committee. Barbicane and his enterprising colleagues, to whom nothing seemed impossible, had just solved the complex question of the projectile, cannon, and powder. Their plan being made, there was nothing left but to put it into execution.

X. One Enemy Against Twenty-Five Millions Of Friends

The American public took great interest in the least details of the Gun Club's enterprise. It followed the committee debates day by day. The most simple preparations for this great experiment, the questions of figures it provoked, the mechanical difficulties to be solved, all excited popular opinion to the highest pitch.

More than a year would elapse between the commencement of the work and its completion; but the interval would not be void of excitement. The place to be chosen for the boring, the casting the metal of the Columbiad, its perilous loading, all this was more than necessary to excite public curiosity. The projectile, once fired, would be out of sight in a few seconds; then what would become of it, how it would behave in space, how it would reach the moon, none but a few privileged persons would see with their own eyes. Thus, then, the preparations for the experiment and the precise details of its execution constituted the real source of interest.

In the meantime the purely scientific attraction of the enterprise was all at once heightened by an incident.

It is known what numerous legions of admirers and friends the Barbicane project had called round its author. But, notwithstanding the number and importance of the majority, it was not destined to be unanimous. One man, one out of all the United States, protested against the Gun Club. He attacked it violently on every occasion, and—for human nature is thus constituted—Barbicane was more sensitive to this one man's opposition than to the applause of all the others.

Nevertheless he well knew the motive of this antipathy, from whence came this solitary enmity, why it was personal and of ancient date; lastly, in what rivalry it had taken root.

The president of the Gun Club had never seen this persevering enemy. Happily, for the meeting of the two men would certainly have had disastrous consequences. This rival was a *savant* like Barbicane, a proud, enterprising, determined, and violent character, a pure Yankee. His name was Captain Nicholl. He lived in Philadelphia.

No one is ignorant of the curious struggle which went on during the Federal war between the projectile and ironclad vessels, the former destined to pierce the latter, the latter determined not to be pierced. Thence came a radical transformation in the navies of the two continents. Cannon-balls and iron plates struggled for supremacy, the former getting larger as the latter got thicker. Ships armed with formidable guns went into the fire under shelter of their invulnerable armour. The Merrimac, Monitor, ram Tennessee, and Wechhausen shot enormous projectiles after having made themselves proof against the projectiles of other ships. They did to others what they would not have others do to them, an immoral principle upon which the whole art of war is based.

Now Barbicane was a great caster of projectiles, and Nicholl was an equally great forger of plate-armour. The one cast night and day at Baltimore, the other forged day and night at Philadelphia. Each followed an essentially different current of ideas.

As soon as Barbicane had invented a new projectile, Nicholl invented a new plate armour. The president of the Gun Club passed his life in piercing holes, the captain in preventing him doing it. Hence a constant rivalry which even touched their persons. Nicholl appeared in

Barbicane's dreams as an impenetrable ironclad against which he split, and Barbicane in Nicholl's dreams appeared like a projectile which ripped him up.

Still, although they ran along two diverging lines, these *savants* would have ended by meeting each other in spite of all the axioms in geometry; but then it would have been on a duel field. Happily for these worthy citizens, so useful to their country, a distance of from fifty to sixty miles separated them, and their friends put such obstacles in the way that they never met.

At present it was not clearly known which of the two inventors held the palm. The results obtained rendered a just decision difficult. It seemed, however, that in the end armour-plate would have to give way to projectiles. Nevertheless, competent men had their doubts. At the latest experiments the cylindro-conical shots of Barbicane had no more effect than pins upon Nicholl's armour-plate. That day the forger of Philadelphia believed himself victorious, and henceforth had nothing but disdain for his rival. But when, later on, Barbicane substituted simple howitzers of 600 lbs. for conical shots, the captain was obliged to go down in his own estimation. It fact, these projectiles, though of mediocre velocity, drilled with holes and broke to pieces armour-plate of the best metal.

Things had reached this point and victory seemed to rest with the projectile, when the war ended the very day that Nicholl terminated a new forged armour-plate. It was a masterpiece of its kind. It defied all the projectiles in the world. The captain had it taken to the Washington Polygon and challenged the president of the Gun Club to pierce it. Barbicane, peace having been made, would not attempt the experiment.

Then Nicholl, in a rage, offered to expose his armour-plate to the shock of any kind of projectile, solid, hollow, round, or conical.

The president, who was determined not to compromise his last success, refused.

Nicholl, excited by this unqualified obstinacy, tried to tempt Barbicane by leaving him every advantage. He proposed to put his plate 200 yards from the gun. Barbicane still refused. At 100 yards? Not even at 75.

"At 50, then," cried the captain, through the newspapers, "at 25 yards from my plate, and I will be behind it."

Barbicane answered that even if Captain Nicholl would be in front of it he would not fire any more.

On this reply, Nicholl could no longer contain himself. He had recourse to personalities; he insinuated cowardice—that the man who refuses to fire a shot from a cannon is very nearly being afraid of it; that, in short, the artillerymen who fight now at six miles distance have prudently substituted mathematical formulae for individual courage, and that there is as much bravery required to quietly wait for a cannon-ball behind armour-plate as to send it according to all the rules of science.

To these insinuations Barbicane answered nothing. Perhaps he never knew about them, for the calculations of his great enterprise absorbed him entirely.

When he made his famous communication to the Gun Club, the anger of Captain Nicholl reached its maximum. Mixed with it was supreme jealousy and a sentiment of absolute powerlessness. How could he invent anything better than a Columbiad 900 feet long? What armour-plate could ever resist a projectile of 30,000 lbs.? Nicholl was at first crushed by this cannon-ball, then he recovered and resolved to crush the proposition by the weight of his best arguments.

He therefore violently attacked the labours of the Gun Club. He sent a number of letters to the newspapers, which they did not refuse to publish. He tried to demolish Barbicane's work scientifically. Once the war begun, he called reasons of every kind to his aid, reasons it must be acknowledged often specious and of bad metal.

Firstly, Barbicane was violently attacked about his figures. Nicholl tried to prove by A + B the falseness of his formulae, and he accused him of being ignorant of the rudimentary principles of ballistics. Amongst other errors, and according to Nicholl's own calculations, it was impossible to give any body a velocity of 12,000 yards a second. He sustained, algebra in hand, that even with that velocity a projectile thus heavy would never pass the limits of the terrestrial atmosphere. It would not even go eight leagues! Better still. Granted the velocity, and taking it as sufficient, the shot would not resist the pressure of the gas developed by the combustion of 1,600,000 pounds of powder, and even if it did resist that pressure, it at least would not support such a temperature; it would melt as it issued from the Columbiad, and would fall in red-hot rain on the heads of the imprudent spectators.

Barbicane paid no attention to these attacks, and went on with his work.

Then Nicholl considered the question in its other aspects. Without speaking of its uselessness from all other points of view, he looked upon the experiment as exceedingly dangerous, both for the citizens who authorised so condemnable a spectacle by their presence, and for the towns near the deplorable cannon. He also remarked that if the projectile did not reach its destination, a result absolutely impossible, it was evident that it would fall on to the earth again, and that the fall of such a mass multiplied by the square of its velocity would singularly damage some point on the globe. Therefore, in such a circumstance, and without any restriction being put upon the rights of free citizens, it was one of those cases in which the intervention of government became necessary, and the safety of all must not be endangered for the good pleasure of a single individual.

It will be seen to what exaggeration Captain Nicholl allowed himself to be carried. He was alone in his opinion. Nobody took any notice of his Cassandra prophecies. They let him exclaim as much as he liked, till his throat was sore if he pleased. He had constituted himself the defender of a cause lost in advance. He was heard but not listened to, and he did not carry off a single admirer from the president of the Gun Club, who did not even take the trouble to refute his rival's arguments.

Nicholl, driven into his last intrenchments, and not being able to fight for his opinion, resolved to pay for it. He therefore proposed in the *Richmond Inquirer* a series of bets conceived in these terms and in an increasing proportion.

He bet that—

1. The funds necessary for the Gun Club's enterprise would not be forthcoming, 1,000 dols.

2. That the casting of a cannon of 900 feet was impracticable and would not succeed, 2,000 dols.

3. That it would be impossible to load the Columbiad, and that the pyroxyle would ignite spontaneously under the weight of the projectile, 3,000 dols.

4. That the Columbiad would burst at the first discharge, 4,000 dols.

5. That the projectile would not even go six miles, and would fall a few seconds after its discharge, 5,000 dols.

It will be seen that the captain was risking an important sum in his invincible obstinacy. No less than 15,000 dols. were at stake.

Notwithstanding the importance of the wager, he received on the 19th of October a sealed packet of superb laconism, couched in these terms:—

“Baltimore, October 18th.

“Done.

“BARBICANE.”

XI. Florida And Texas

There still remained one question to be decided—a place favourable to the experiment had to be chosen. According to the recommendation of the Cambridge Observatory the gun must be aimed perpendicularly to the plane of the horizon—that is to say, towards the zenith. Now the moon only appears in the zenith in the places situated between 0° and 28° of latitude, or, in other terms, when her declination is only 28°. The question was, therefore, to determine the exact point of the globe where the immense Columbiad should be cast.

On the 20th of October the Gun Club held a general meeting. Barbicane brought a magnificent map of the United States by Z. Belltropp. But before he had time to unfold it J.T. Maston rose with his habitual vehemence, and began to speak as follows:—

“Honourable colleagues, the question we are to settle to-day is really of national importance, and will furnish us with an occasion for doing a great act of patriotism.”

The members of the Gun Club looked at each other without understanding what the orator was coming to.

“Not one of you,” he continued, “would think of doing anything to lessen the glory of his country, and if there is one right that the Union may claim it is that of harbouring in its bosom the formidable cannon of the Gun Club. Now, under the present circumstances—”

“Will you allow me—” said Barbicane.

“I demand the free discussion of ideas,” replied the impetuous J.T. Maston, “and I maintain that the territory from which our glorious projectile will rise ought to belong to the Union.”

“Certainly,” answered several members.

“Well, then, as our frontiers do not stretch far enough, as on the south the ocean is our limit, as we must seek beyond the United States and in a neighbouring country this 28th parallel, this is all a legitimate *casus belli*, and I demand that war should be declared against Mexico!”

“No, no!” was cried from all parts.

“No!” replied J.T. Maston. “I am much astonished at hearing such a word in these precincts!”

“But listen—”

“Never! never!” cried the fiery orator. “Sooner or later this war will be declared, and I demand that it should be this very day.”

“Maston,” said Barbicane, making his bell go off with a crash, “I agree with you that the experiment cannot and ought not to be made anywhere but on the soil of the Union, but if I had been allowed to speak before, and you had glanced at this map, you would know that it is perfectly useless to declare war against our neighbours, for certain frontiers of the United States extend beyond the 28th parallel. Look, we have at our disposition all the southern part of Texas and Florida.”

This incident had no consequences; still it was not without regret that J.T. Maston allowed himself to be convinced. It was, therefore, decided that the Columbiad should be cast either on the soil of Texas or on that of Florida. But this decision was destined to create an unexampled rivalry between the towns of these two states.

The 28th parallel, when it touches the American coast, crosses the peninsula of Florida, and divides it into two nearly equal portions. Then, plunging into the Gulf of Mexico, it subtends the arc formed by the coasts of Alabama, Mississippi, and Louisiana; then skirting Texas, off which it cuts an angle, it continues its direction over Mexico, crosses the Sonora and Old California, and loses itself in the Pacific Ocean; therefore only the portions of Texas and Florida situated below this parallel fulfilled the requisite conditions of latitude recommended by the Observatory of Cambridge.

The southern portion of Florida contains no important cities. It only bristles with forts raised against wandering Indians. One town only, Tampa Town, could put in a claim in favour of its position.

In Texas, on the contrary, towns are more numerous and more important. Corpus Christi in the county of Nuaces, and all the cities situated on the Rio Bravo, Laredo, Comalites, San Ignacio in Web, Rio Grande city in Starr, Edinburgh in Hidalgo, Santa-Rita, El Panda, and Brownsville in Cameron, formed a powerful league against the pretensions of Florida.

The decision, therefore, was hardly made public before the Floridan and Texican deputies flocked to Baltimore by the shortest way. From that moment President Barbicane and the influential members of the Gun Club were besieged day and night by formidable claims. If seven towns of Greece contended for the honour of being Homer's birthplace, two entire states threatened to fight over a cannon.

These rival parties were then seen marching with weapons about the streets of the town. Every time they met a fight was imminent, which would have had disastrous consequences. Happily the prudence and skill of President Barbicane warded off this danger. Personal demonstrations found an outlet in the newspapers of the different states. It was thus that the *New York Herald* and the *Tribune* supported the claims of Texas, whilst the *Times* and the *American Review* took the part of the Floridan deputies. The members of the Gun Club did not know which to listen to.

Texas came up proudly with its twenty-six counties, which it seemed to put in array; but Florida answered that twelve counties proved more than twenty-six in a country six times smaller.

Texas bragged of its 33,000 inhabitants; but Florida, much smaller, boasted of being much more densely populated with 56,000. Besides, Florida accused Texas of being the home of paludian fevers, which carried off, one year with another, several thousands of inhabitants, and Florida was not far wrong.

In its turn Texas replied that Florida need not envy its fevers, and that it was, at least, imprudent to call other countries unhealthy when Florida itself had chronic "vomito negro," and Texas was not far wrong.

"Besides," added the Texicans through the *New York Herald*, "there are rights due to a state that grows the best cotton in all America, a state which produces holm oak for building ships, a state that contains superb coal and mines of iron that yield fifty per cent. of pure ore."

To that the *American Review* answered that the soil of Florida, though not so rich, offered better conditions for the casting of the Columbiad, as it was composed of sand and clay-ground.

"But," answered the Texicans, "before anything can be cast in a place, it must get to that place; now communication with Florida is difficult, whilst the coast of Texas offers Galveston Bay, which is fourteen leagues round, and could contain all the fleets in the world."

“Why,” replied the newspapers devoted to Florida, “your Galveston Bay is situated above the 29th parallel, whilst our bay of Espiritu-Santo opens precisely at the 28th degree of latitude, and by it ships go direct to Tampa Town.”

“A nice bay truly!” answered Texas; “it is half-choked up with sand.”

“Any one would think, to hear you talk,” cried Florida, “that I was a savage country.”

“Well, the Seminoles do still wander over your prairies!”

“And what about your Apaches and your Comanches—are they civilised?”

The war had been thus kept up for some days when Florida tried to draw her adversary upon another ground, and one morning the *Times* insinuated that the enterprise being “essentially American,” it ought only to be attempted upon an “essentially American” territory.

At these words Texas could not contain itself.

“American!” it cried, “are we not as American as you? Were not Texas and Florida both incorporated in the Union in 1845?”

“Certainly,” answered the *Times*, “but we have belonged to America since 1820.”

“Yes,” replied the *Tribune*, “after having been Spanish or English for 200 years, you were sold to the United States for 5,000,000 of dollars!”

“What does that matter?” answered Florida. “Need we blush for that? Was not Louisiana bought in 1803 from Napoleon for 16,000,000 of dollars?”

“It is shameful!” then cried the Texican deputies. “A miserable slice of land like Florida to dare to compare itself with Texas, which, instead of being sold, made itself independent, which drove out the Mexicans on the 2nd of March, 1836, which declared itself Federative Republican after the victory gained by Samuel Houston on the banks of the San Jacinto over the troops of Santa-Anna—a country, in short, which voluntarily joined itself to the United States of America!”

“Because it was afraid of the Mexicans!” answered Florida.

“Afraid!” From the day this word, really too cutting, was pronounced, the situation became intolerable. An engagement was expected between the two parties in the streets of Baltimore. The deputies were obliged to be watched.

President Barbicane was half driven wild. Notes, documents, and letters full of threats inundated his house. Which course ought he to decide upon? In the point of view of fitness of soil, facility of communications, and rapidity of transport, the rights of the two states were really equal. As to the political personalities, they had nothing to do with the question.

Now this hesitation and embarrassment had already lasted some time when Barbicane resolved to put an end to it; he called his colleagues together, and the solution he proposed to them was a profoundly wise one, as will be seen from the following:—

“After due consideration,” said he, “of all that has just occurred between Florida and Texas, it is evident that the same difficulties will again crop up between the towns of the favoured state. The rivalry will be changed from state to city, and that is all. Now Texas contains eleven towns with the requisite conditions that will dispute the honour of the enterprise, and that will create fresh troubles for us, whilst Florida has but one; therefore I decide for Tampa Town!”

The Texican deputies were thunderstruck at this decision. It put them into a terrible rage, and they sent nominal provocations to different members of the Gun Club. There was only one

course for the magistrates of Baltimore to take, and they took it. They had the steam of a special train got up, packed the Texicans into it, whether they would or no, and sent them away from the town at a speed of thirty miles an hour.

But they were not carried off too quickly to hurl a last and threatening sarcasm at their adversaries.

Making allusion to the width of Florida, a simple peninsula between two seas, they pretended it would not resist the shock, and would be blown up the first time the cannon was fired.

“Very well! let it be blown up!” answered the Floridans with a laconism worthy of ancient times.

XII. “Urbi Et Orbi”

The astronomical, mechanical, and topographical difficulties once removed, there remained the question of money. An enormous sum was necessary for the execution of the project. No private individual, no single state even, could have disposed of the necessary millions.

President Barbicane had resolved—although the enterprise was American—to make it a business of universal interest, and to ask every nation for its financial co-operation. It was the bounded right and duty of all the earth to interfere in the business of the satellite. The subscription opened at Baltimore, for this end extended thence to all the world—*urbi et orbi*.

This subscription was destined to succeed beyond all hope; yet the money was to be given, not lent. The operation was purely disinterested, in the literal meaning of the word, and offered no chance of gain.

But the effect of Barbicane’s communication had not stopped at the frontiers of the United States; it had crossed the Atlantic and Pacific, had invaded both Asia and Europe, both Africa and Oceania. The observatories of the Union were immediately put into communication with the observatories of foreign countries; some—those of Paris, St. Petersburg, the Cape, Berlin, Altona, Stockholm, Warsaw, Hamburg, Buda, Bologna, Malta, Lisbon, Benares, Madras, and Pekin—sent their compliments to the Gun Club; the others prudently awaited the result.

As to the Greenwich Observatory, seconded by the twenty-two astronomical establishments of Great Britain, it made short work of it; it boldly denied the possibility of success, and took up Captain Nicholl’s theories. Whilst the different scientific societies promised to send deputies to Tampa Town, the Greenwich staff met and contemptuously dismissed the Barbicane proposition. This was pure English jealousy and nothing else.

Generally speaking, the effect upon the world of science was excellent, and from thence it passed to the masses, who, in general, were greatly interested in the question, a fact of great importance, seeing those masses were to be called upon to subscribe a considerable capital.

On the 8th of October President Barbicane issued a manifesto, full of enthusiasm, in which he made appeal to “all persons on the face of the earth willing to help.” This document, translated into every language, had great success.

Subscriptions were opened in the principal towns of the Union with a central office at the Baltimore Bank, 9, Baltimore street; then subscriptions were opened in the different countries of the two continents:—At Vienna, by S.M. de Rothschild; St. Petersburg, Stieglitz and Co.; Paris, Crédit Mobilier; Stockholm, Tottie and Arfuredson; London, N.M. de Rothschild and Son; Turin, Ardouin and Co.; Berlin, Mendelssohn; Geneva, Lombard, Odier, and Co.; Constantinople, Ottoman Bank; Brussels, J. Lambert; Madrid, Daniel Weisweller; Amsterdam, Netherlands Credit Co.; Rome, Torlonia and Co.; Lisbon, Lecesne; Copenhagen, Private Bank; Buenos Ayres, Mana Bank; Rio Janeiro, Mana Bank; Monte Video, Mana Bank; Valparaiso, Thomas La Chambre and Co.; Lima, Thomas La Chambre and Co.; Mexico, Martin Daran and Co.

Three days after President Barbicane’s manifesto 400,000 dollars were received in the different towns of the Union. With such a sum in hand the Gun Club could begin at once.

But a few days later telegrams informed America that foreign subscriptions were pouring in rapidly. Certain countries were distinguished by their generosity; others let go their money less easily. It was a matter of temperament.

However, figures are more eloquent than words, and the following is an official statement of the sums paid to the credit of the Gun Club when the subscription was closed:—

The contingent of Russia was the enormous sum of 368,733 roubles. This need astonish no one who remembers the scientific taste of the Russians and the impetus which they have given to astronomical studies, thanks to their numerous observatories, the principal of which cost 2,000,000 roubles.

France began by laughing at the pretensions of the Americans. The moon served as an excuse for a thousand stale puns and a score of vaudevilles in which bad taste contested the palm with ignorance. But, as the French formerly paid after singing, they now paid after laughing, and subscribed a sum of 1,258,930 francs. At that price they bought the right to joke a little.

Austria, in the midst of her financial difficulties, was sufficiently generous. Her part in the public subscription amounted to 216,000 florins, which were welcome.

Sweden and Norway contributed 52,000 rix-dollars. The figure was small considering the country; but it would certainly have been higher if a subscription had been opened at Christiania as well as at Stockholm. For some reason or other the Norwegians do not like to send their money to Norway.

Prussia, by sending 250,000 thalers, testified her approbation of the enterprise. Her different observatories contributed an important sum, and were amongst the most ardent in encouraging President Barbicane.

Turkey behaved generously, but she was personally interested in the business; the moon, in fact, rules the course of her years and her Ramadan fast. She could do no less than give 1,372,640 piastres, and she gave them with an ardour that betrayed, however, a certain pressure from the Government of the Porte.

Belgium distinguished herself amongst all the second order of States by a gift of 513,000 francs, about one penny and a fraction for each inhabitant.

Holland and her colonies contributed 110,000 florins, only demanding a discount of five per cent., as she paid ready money.

Denmark, rather confined for room, gave, notwithstanding, 9,000 ducats, proving her love for scientific experiments.

The Germanic Confederation subscribed 34,285 florins; more could not be asked from her; besides, she would not have given more.

Although in embarrassed circumstances, Italy found 2,000,000 francs in her children’s pockets, but by turning them well inside out. If she had then possessed Venetia she would have given more, but she did not yet possess Venetia.

The Pontifical States thought they could not send less than 7,040 Roman crowns, and Portugal pushed her devotion to the extent of 3,000 cruzades.

Mexico gent the widow’s mite, 86 piastres; but empires in course of formation are always in rather embarrassed circumstances.

Switzerland sent the modest sum of 257 francs to the American scheme. It must be frankly stated that Switzerland only looked upon the practical side of the operation; the action of sending a bullet to the moon did not seem of a nature sufficient for the establishing of any communication with the Queen of Night, so Switzerland thought it imprudent to engage capital in an enterprise depending upon such uncertain events. After all, Switzerland was, perhaps, right.

As to Spain, she found it impossible to get together more than 110 reals. She gave as an excuse that she had her railways to finish. The truth is that science is not looked upon very favourably in that country; it is still a little behindhand. And then certain Spaniards, and not the most ignorant either, had no clear conception of the size of the projectile compared with that of the moon; they feared it might disturb the satellite from her orbit, and make her fall on to the surface of the terrestrial globe. In that case it was better to have nothing to do with it, which they carried out, with that small exception.

England alone remained. The contemptuous antipathy with which she received Barbicane's proposition is known. The English have but a single mind in their 25,000,000 of bodies which Great Britain contains. They gave it to be understood that the enterprise of the Gun Club was contrary "to the principle of non-intervention," and they did not subscribe a single farthing.

At this news the Gun Club contented itself with shrugging its shoulders, and returned to its great work. When South America—that is to say, Peru, Chili, Brazil, the provinces of La Plata and Columbia—had poured into their hands their quota of 300,000 dollars, it found itself possessed of a considerable capital of which the following is a statement:—

United States subscription, 4,000,000 dollars; foreign subscriptions, 1,446,675 dollars; total, 5,446,675 dollars.

This was the large sum poured by the public into the coffers of the Gun Club.

No one need be surprised at its importance. The work of casting, boring, masonry, transport of workmen, and their installation in an almost uninhabited country, the construction of furnaces and workshops, the manufacturing tools, powder, projectile and incidental expenses would, according to the estimates, absorb nearly the whole. Some of the cannon-shots fired during the war cost 1,000 dollars each; that of President Barbicane, unique in the annals of artillery, might well cost 5,000 times more.

On the 20th of October a contract was made with the Goldspring Manufactory, New York, which during the war had furnished Parrott with his best cast-iron guns.

It was stipulated between the contracting parties that the Goldspring Manufactory should pledge itself to send to Tampa Town, in South Florida, the necessary materials for the casting of the Columbiad.

This operation was to be terminated, at the latest, on the 15th of the next October, and the cannon delivered in good condition, under penalty of 100 dollars a day forfeit until the moon should again present herself under the same conditions—that is to say, during eighteen years and eleven days.

The engagement of the workmen, their pay, and the necessary transports all to be made by the Goldspring Company.

This contract, made in duplicate, was signed by I. Barbicane, president of the Gun Club, and J. Murphison, Manager of the Goldspring Manufactory, who thus signed on the part of the contracting parties.

XIII. Stony Hill

Since the choice made by the members of the Gun Club to the detriment of Texas, every one in America—where every one knows how to read—made it his business to study the geography of Florida. Never before had the booksellers sold so many *Bertram's Travels in Florida*, *Roman's Natural History of East and West Florida*, *Williams' Territory of Florida*, and *Cleland on the Culture of the Sugar Cane in East Florida*. New editions of these works were required. There was quite a rage for them.

Barbicane had something better to do than to read; he wished to see with his own eyes and choose the site of the Columbiad. Therefore, without losing a moment, he put the funds necessary for the construction of a telescope at the disposition of the Cambridge Observatory, and made a contract with the firm of Breadwill and Co., of Albany, for the making of the aluminium projectile; then he left Baltimore accompanied by J.T. Maston, Major Elphinstone, and the manager of the Goldspring Manufactory.

The next day the four travelling companions reached New Orleans. There they embarked on board the *Tampico*, a despatch-boat belonging to the Federal Navy, which the Government had placed at their disposal, and, with all steam on, they quickly lost sight of the shores of Louisiana.

The passage was not a long one; two days after its departure the *Tampico*, having made four hundred and eighty miles, sighted the Floridian coast. As it approached, Barbicane saw a low, flat coast, looking rather unfertile. After coasting a series of creeks rich in oysters and lobsters, the *Tampico* entered the Bay of Espiritu-Santo.

This bay is divided into two long roadsteads, those of Tampa and Hillisboro, the narrow entrance to which the steamer soon cleared. A short time afterwards the batteries of Fort Brooke rose above the waves and the town of Tampa appeared, carelessly lying on a little natural harbour formed by the mouth of the river Hillisboro.

There the *Tampico* anchored on October 22nd, at seven p.m.; the four passengers landed immediately.

Barbicane felt his heart beat violently as he set foot on Floridian soil; he seemed to feel it with his feet like an architect trying the solidity of a house. J.T. Maston scratched the ground with his steel hook.

"Gentlemen," then said Barbicane, "we have no time to lose, and we will set off on horseback to-morrow to survey the country."

The minute Barbicane landed the three thousand inhabitants of Tampa Town went out to meet him, an honour quite due to the president of the Gun Club, who had decided in their favour. They received him with formidable exclamations, but Barbicane escaped an ovation by shutting himself up in his room at the Franklin Hotel and refusing to see any one.

The next day, October 23rd, small horses of Spanish race, full of fire and vigour, pawed the ground under his windows. But, instead of four, there were fifty, with their riders. Barbicane went down accompanied by his three companions, who were at first astonished to find themselves in the midst of such a cavalcade. He remarked besides that each horseman carried a carbine slung across his shoulders and pistols in his holsters. The reason for such a display of force was immediately given him by a young Floridian, who said to him—

"Sir, the Seminoles are there."

“What Seminoles?”

“Savages who frequent the prairies, and we deemed it prudent to give you an escort.”

“Pooh!” exclaimed J.T. Maston as he mounted his steed.

“It is well to be on the safe side,” answered the Floridian.

“Gentlemen,” replied Barbicane, “I thank you for your attention, and now let us be off.”

The little troop set out immediately, and disappeared in a cloud of dust. It was five a.m.; the sun shone brilliantly already, and the thermometer indicated 84°, but fresh sea breezes moderated this excessive heat.

Barbicane, on leaving Tampa Town, went down south and followed the coast to Alifia Creek. This small river falls into Hillisboro Bay, twelve miles below Tampa Town. Barbicane and his escort followed its right bank going up towards the east. The waves of the bay disappeared behind an inequality in the ground, and the Floridian country was alone in sight.

Florida is divided into two parts; the one to the north, more populous and less abandoned, has Tallahassee for capital, and Pensacola, one of the principal marine arsenals of the United States; the other, lying between the Atlantic and the Gulf of Mexico, is only a narrow peninsula, eaten away by the current of the Gulf Stream—a little tongue of land lost amidst a small archipelago, which the numerous vessels of the Bahama Channel double continually. It is the advanced sentinel of the gulf of great tempests. The superficial area of this state measures 38,033,267 acres, amongst which one had to be chosen situated beyond the 28th parallel and suitable for the enterprise. As Barbicane rode along he attentively examined the configuration of the ground and its particular distribution.

Florida, discovered by Juan Ponce de Leon in 1512, on Palm Sunday, was first of all named *Pascha Florida*. It was well worthy of that designation with its dry and arid coasts. But a few miles from the shore the nature of the ground gradually changed, and the country showed itself worthy of its name; the soil was cut up by a network of creeks, rivers, watercourses, ponds, and small lakes; it might have been mistaken for Holland or Guiana; but the ground gradually rose and soon showed its cultivated plains, where all the vegetables of the North and South grow in perfection, its immense fields, where a tropical sun and the water conserved in its clayey texture do all the work of cultivating, and lastly its prairies of pineapples, yams, tobacco, rice, cotton, and sugarcanes, which extended as far as the eye could reach, spreading out their riches with careless prodigality.

Barbicane appeared greatly satisfied on finding the progressive elevation of the ground, and when J.T. Maston questioned him on the subject,

“My worthy friend,” said he, “it is greatly to our interest to cast our Columbiad on elevated ground.”

“In order to be nearer the moon?” exclaimed the secretary of the Gun Club.

“No,” answered Barbicane, smiling. “What can a few yards more or less matter? No, but on elevated ground our work can be accomplished more easily; we shall not have to struggle against water, which will save us long and expensive tubings, and that has to be taken into consideration when a well 900 feet deep has to be sunk.”

“You are right,” said Murchison, the engineer; “we must, as much as possible, avoid watercourses during the casting; but if we meet with springs they will not matter much; we can exhaust them with our machines or divert them from their course. Here we have not to work at an artesian well, narrow and dark, where all the boring implements have to work in

the dark. No; we can work under the open sky, with spade and pickaxe, and, by the help of blasting, our work will not take long."

"Still," resumed Barbicane, "if by the elevation of the ground or its nature we can avoid a struggle with subterranean waters, we can do our work more rapidly and perfectly; we must, therefore, make our cutting in ground situated some thousands of feet above the level of the sea."

"You are right, Mr. Barbicane, and, if I am not mistaken, we shall soon find a suitable spot."

"I should like to see the first spadeful turned up," said the president.

"And I the last!" exclaimed J.T. Maston.

"We shall manage it, gentlemen," answered the engineer; "and, believe me, the Goldspring Company will not have to pay you any forfeit for delay."

"Faith! it had better not," replied J.T. Maston; "a hundred dollars a day till the moon presents herself in the same conditions—that is to say, for eighteen years and eleven days—do you know that would make 658,000 dollars?"

"No, sir, we do not know, and we shall not need to learn."

About ten a.m. the little troop had journeyed about twelve miles; to the fertile country succeeded a forest region. There were the most varied perfumes in tropical profusion. The almost impenetrable forests were made up of pomegranates, orange, citron, fig, olive, and apricot trees, bananas, huge vines, the blossoms and fruit of which rivalled each other in colour and perfume. Under the perfumed shade of these magnificent trees sang and fluttered a world of brilliantly-coloured birds, amongst which the crab-eater deserved a jewel casket, worthy of its feathered gems, for a nest.

J.T. Maston and the major could not pass through such opulent nature without admiring its splendid beauty.

But President Barbicane, who thought little of these marvels, was in a hurry to hasten onwards; this country, so fertile, displeased him by its very fertility; without being otherwise hydropical, he felt water under his feet, and sought in vain the signs of incontestable aridity.

In the meantime they journeyed on. They were obliged to ford several rivers, and not without danger, for they were infested with alligators from fifteen to eighteen feet long. J.T. Maston threatened them boldly with his formidable hook, but he only succeeded in frightening the pelicans, phaetons, and teals that frequented the banks, while the red flamingoes looked on with a stupid stare.

At last these inhabitants of humid countries disappeared in their turn. The trees became smaller and more thinly scattered in smaller woods; some isolated groups stood amidst immense plains where ranged herds of startled deer.

"At last!" exclaimed Barbicane, rising in his stirrups. "Here is the region of pines."

"And savages," answered the major.

In fact, a few Seminoles appeared on the horizon. They moved about backwards and forwards on their fleet horses, brandishing long lances or firing their guns with a dull report. However, they confined themselves to these hostile demonstrations, which had no effect on Barbicane and his companions.

They were then in the middle of a rocky plain, a vast open space of several acres in extent which the sun covered with burning rays. It was formed by a wide elevation of the soil, and

seemed to offer to the members of the Gun Club all the required conditions for the construction of their Columbiad.

“Halt!” cried Barbicane, stopping. “Has this place any name?”

“It is called Stony Hill,” answered the Floridians.

Barbicane, without saying a word, dismounted, took his instruments, and began to fix his position with extreme precision. The little troop drawn up around him watched him in profound silence.

At that moment the sun passed the meridian. Barbicane, after an interval, rapidly noted the result of his observation, and said—

“This place is situated 1,800 feet above the sea level in lat. 27° 7’ and West long. 5° 7’ by the Washington meridian. It appears to me by its barren and rocky nature to offer every condition favourable to our enterprise; we will therefore raise our magazines, workshops, furnaces, and workmen’s huts here, and it is from this very spot,” said he, stamping upon it with his foot, “the summit of Stony Hill, that our projectile will start for the regions of the solar world!”

XIV. Pickaxe And Trowel

That same evening Barbicane and his companions returned to Tampa Town, and Murchison, the engineer, re-embarked on board the *Tampico* for New Orleans. He was to engage an army of workmen to bring back the greater part of the working-stock. The members of the Gun Club remained at Tampa Town in order to set on foot the preliminary work with the assistance of the inhabitants of the country.

Eight days after its departure the *Tampico* returned to the Espiritu-Santo Bay with a fleet of steamboats. Murchison had succeeded in getting together 1,500 workmen. In the evil days of slavery he would have lost his time and trouble; but since America, the land of liberty, has only contained freemen, they flock wherever they can get good pay. Now money was not wanting to the Gun Club; it offered a high rate of wages with considerable and proportionate perquisites. The workman enlisted for Florida could, once the work finished, depend upon a capital placed in his name in the bank of Baltimore.

Murchison had therefore only to pick and choose, and could be severe about the intelligence and skill of his workmen. He enrolled in his working legion the pick of mechanics, stokers, iron-founders, lime-burners, miners, brickmakers, and artisans of every sort, white or black without distinction of colour. Many of them brought their families with them. It was quite an emigration.

On the 31st of October, at 10 a.m., this troop landed on the quays of Tampa Town. The movement and activity which reigned in the little town that had thus doubled its population in a single day may be imagined. In fact, Tampa Town was enormously benefited by this enterprise of the Gun Club, not by the number of workmen who were immediately drafted to Stony Hill, but by the influx of curious idlers who converged by degrees from all points of the globe towards the Floridian peninsula.

During the first few days they were occupied in unloading the flotilla of the tools, machines, provisions, and a large number of plate iron houses made in pieces separately pieced and numbered. At the same time Barbicane laid the first sleepers of a railway fifteen miles long that was destined to unite Stony Hill and Tampa Town.

It is known how American railways are constructed, with capricious bends, bold slopes, steep hills, and deep valleys. They do not cost much and are not much in their way, only their trains run off or jump off as they please. The railway from Tampa Town to Stony Hill was but a trifle, and wanted neither much time nor much money for its construction.

Barbicane was the soul of this army of workmen who had come at his call. He animated them, communicated to them his ardour, enthusiasm, and conviction. He was everywhere at once, as if endowed with the gift of ubiquity, and always followed by J.T. Maston, his bluebottle fly. His practical mind invented a thousand things. With him there were no obstacles, difficulties, or embarrassment. He was as good a miner, mason, and mechanic as he was an artilleryman, having an answer to every question, and a solution to every problem. He corresponded actively with the Gun Club and the Goldspring Manufactory, and day and night the *Tampico* kept her steam up awaiting his orders in Hillisboro harbour.

Barbicane, on the 1st of November, left Tampa Town with a detachment of workmen, and the very next day a small town of workmen’s houses rose round Stony Hill. They surrounded it with palisades, and from its movement and ardour it might soon have been taken for one of the great cities of the Union. Life was regulated at once and work began in perfect order.

Careful boring had established the nature of the ground, and digging was begun on November 4th. That day Barbicane called his foremen together and said to them—

“You all know, my friends, why I have called you together in this part of Florida. We want to cast a cannon nine feet in diameter, six feet thick, and with a stone revetment nineteen and a half feet thick; we therefore want a well 60 feet wide and 900 feet deep. This large work must be terminated in nine months. You have, therefore, 2,543,400 cubic feet of soil to dig out in 255 days—that is to say, 10,000 cubic feet a day. That would offer no difficulty if you had plenty of elbow-room, but as you will only have a limited space it will be more trouble. Nevertheless as the work must be done it will be done, and I depend upon your courage as much as upon your skill.”

At 8 a.m. the first spadeful was dug out of the Floridian soil, and from that moment this useful tool did not stop idle a moment in the hands of the miner. The gangs relieved each other every three hours.

Besides, although the work was colossal it did not exceed the limit of human capability. Far from that. How many works of much greater difficulty, and in which the elements had to be more directly contended against, had been brought to a successful termination! Suffice it to mention the well of Father Joseph, made near Cairo by the Sultan Saladin at an epoch when machines had not yet appeared to increase the strength of man a hundredfold, and which goes down to the level of the Nile itself at a depth of 300 feet! And that other well dug at Coblentz by the Margrave Jean of Baden, 600 feet deep! All that was needed was a triple depth and a double width, which made the boring easier. There was not one foreman or workman who doubted about the success of the operation.

An important decision taken by Murchison and approved of by Barbicane accelerated the work. An article in the contract decided that the Columbiad should be hooped with wrought-iron—a useless precaution, for the cannon could evidently do without hoops. This clause was therefore given up. Hence a great economy of time, for they could then employ the new system of boring now used for digging wells, by which the masonry is done at the same time as the boring. Thanks to this very simple operation they were not obliged to prop up the ground; the wall kept it up and went down by its own weight.

This manoeuvre was only to begin when the spade should have reached the solid part of the ground.

On the 4th of November fifty workmen began to dig in the very centre of the inclosure surrounded by palisades—that is to say, the top of Stony Hill—a circular hole sixty feet wide.

The spade first turned up a sort of black soil six inches deep, which it soon carried away. To this soil succeeded two feet of fine sand, which was carefully taken out, as it was to be used for the casting.

After this sand white clay appeared, similar to English chalk, and which was four feet thick.

Then the pickaxes rang upon the hard layer, a species of rock formed by very dry petrified shells. At that point the hole was six and a half feet deep, and the masonry was begun.

At the bottom of that excavation they made an oak wheel, a sort of circle strongly bolted and of enormous strength; in its centre a hole was pierced the size of the exterior diameter of the Columbiad. It was upon this wheel that the foundations of the masonry were placed, the hydraulic cement of which joined the stones solidly together. After the workmen had bricked up the space from the circumference to the centre, they found themselves inclosed in a well twenty-one feet wide.

When this work was ended the miners began again with spade and pickaxe, and set upon the rock under the wheel itself, taking care to support it on extremely strong tressels; every time the hole was two feet deeper they took away the tressels; the wheel gradually sank, taking with it its circle of masonry, at the upper layer of which the masons worked incessantly, taking care to make vent-holes for the escape of gas during the operation of casting.

This kind of work required great skill and constant attention on the part of the workmen; more than one digging under the wheel was dangerous, and some were even mortally wounded by the splinters of stone; but their energy did not slacken for a moment by day nor night; by day, when the sun's rays sent the thermometer up to 99° on the calcined planes; by night, under the white waves of electric light, the noise of the pickaxe on the rock, the blasting and the machines, together with the wreaths of smoke scattered through the air, traced a circle of terror round Stony Hill, which the herds of buffaloes and the detachments of Seminoles never dared to pass.

In the meantime the work regularly advanced; steam-cranes speeded the carrying away of the rubbish; of unexpected obstacles there were none; all the difficulties had been foreseen and guarded against.

When the first month had gone by the well had attained the depth assigned for the time—i.e., 112 feet. In December this depth was doubled, and tripled in January. During February the workmen had to contend against a sheet of water which sprang from the ground. They were obliged to employ powerful pumps and apparatus of compressed air to drain it off, so as to close up the orifice from which it issued, just as leaks are caulked on board ship. At last they got the better of these unwelcome springs, only in consequence of the loosening of the soil the wheel partially gave way, and there was a landslip. The frightful force of this bricked circle, more than 400 feet high, may be imagined! This accident cost the life of several workmen. Three weeks had to be taken up in propping the stone revetment and making the wheel solid again. But, thanks to the skill of the engineer and the power of the machines, it was all set right, and the boring continued.

No fresh incident henceforth stopped the progress of the work, and on the 10th of June, twenty days before the expiration of the delay fixed by Barbicane, the well, quite bricked round, had reached the depth of 900 feet. At the bottom the masonry rested upon a massive block, thirty feet thick, whilst at the top it was on a level with the soil.

President Barbicane and the members of the Gun Club warmly congratulated the engineer Murchison; his cyclopean work had been accomplished with extraordinary rapidity.

During these eight months Barbicane did not leave Stony Hill for a minute; whilst he narrowly watched over the boring operations, he took every precaution to insure the health and well-being of his workmen, and he was fortunate enough to avoid the epidemics common to large agglomerations of men, and so disastrous in those regions of the globe exposed to tropical influence.

It is true that several workmen paid with their lives for the carelessness engendered by these dangerous occupations; but such deplorable misfortunes cannot be avoided, and these are details that Americans pay very little attention to. They are more occupied with humanity in general than with individuals in particular. However, Barbicane professed the contrary principles, and applied them upon every occasion. Thanks to his care, to his intelligence and respectful intervention in difficult cases, to his prodigious and humane wisdom, the average of catastrophes did not exceed that of cities on the other side of the Atlantic, amongst others those of France, where they count about one accident upon every 200,000 francs of work.

XV. The Ceremony Of The Casting

During the eight months that were employed in the operation of boring the preparatory works of the casting had been conducted simultaneously with extreme rapidity; a stranger arriving at Stony Hill would have been much surprised at what he saw there.

Six hundred yards from the well, and standing in a circle round it as a central point, were 1,200 furnaces, each six feet wide and three yards apart. The line made by these 1,200 furnaces was two miles long. They were all built on the same model, with high quadrangular chimneys, and had a singular effect. J.T. Maston thought the architectural arrangement superb. It reminded him of the monuments at Washington. He thought there was nothing finer in the world, not even in Greece, where he acknowledged never to have been.

It will be remembered that at their third meeting the committee decided to use cast-iron for the Columbiad, and in particular the grey description. This metal is, in fact, the most tenacious, ductile, and malleable, suitable for all moulding operations, and when smelted with pit coal it is of superior quality for engine-cylinders, hydraulic presses, &c.

But cast-iron, if it has undergone a single fusion, is rarely homogeneous enough; and it is by means of a second fusion that it is purified, refined, and dispossessed of its last earthly deposits.

Before being forwarded to Tampa Town, the iron ore, smelted in the great furnaces of Goldspring, and put in contact with coal and silicium heated to a high temperature, was transformed into cast-iron. After this first operation the metal was taken to Stony Hill. But there were 136 millions of pounds of cast-iron, a bulk too expensive to be sent by railway; the price of transport would have doubled that of the raw material. It appeared preferable to freight vessels at New York and to load them with the iron in bars; no less than sixty-eight vessels of 1,000 tons were required, quite a fleet, which on May 3rd left New York, took the Ocean route, coasted the American shores, entered the Bahama Channel, doubled the point of Florida, and on the 10th of the same month entered the Bay of Espiritu-Santo and anchored safely in the port of Tampa Town. There the vessels were unloaded and their cargo carried by railway to Stony Hill, and about the middle of January the enormous mass of metal was delivered at its destination.

It will easily be understood that 1,200 furnaces were not too many to melt these 60,000 tons of iron simultaneously. Each of these furnaces contained about 1,400,000 lbs. of metal; they had been built on the model of those used for the casting of the Rodman gun; they were trapezoidal in form, with a high elliptical arch. The warming apparatus and the chimney were placed at the two extremities of the furnace, so that it was equally heated throughout. These furnaces, built of fireproof brick, were filled with coal-grates and a “sole” for the bars of iron; this sole, inclosed at an angle of 25°, allowed the metal to flow into the receiving-troughs; from thence 1,200 converging trenches carried it down to the central well.

The day following that upon which the works of masonry and casting were terminated, Barbicane set to work upon the interior mould; his object now was to raise in the centre of the well, with a coincident axis, a cylinder 900 feet high and nine in diameter, to exactly fill up the space reserved for the bore of the Columbiad. This cylinder was made of a mixture of clay and sand, with the addition of hay and straw. The space left between the mould and the masonry was to be filled with the molten metal, which would thus make the sides of the cannon six feet thick.

This cylinder, in order to have its equilibrium maintained, had to be consolidated with iron bands and fixed at intervals by means of cross-clamps fastened into the stone lining; after the casting these clamps would be lost in the block of metal, which would not be the worse for them.

This operation was completed on the 8th of July, and the casting was fixed for the 10th.

“The casting will be a fine ceremony,” said J.T. Maston to his friend Barbicane.

“Undoubtedly,” answered Barbicane, “but it will not be a public one!”

“What! you will not open the doors of the inclosure to all comers?”

“Certainly not; the casting of the Columbiad is a delicate, not to say a dangerous, operation, and I prefer that it should be done with closed doors. When the projectile is discharged you may have a public ceremony if you like, but till then, no!”

The president was right; the operation might be attended with unforeseen danger, which a large concourse of spectators would prevent being averted. It was necessary to preserve complete freedom of movement. No one was admitted into the inclosure except a delegation of members of the Gun Club who made the voyage to Tampa Town. Among them was the brisk Bilsby, Tom Hunter, Colonel Blomsberry, Major Elphinstone, General Morgan, and *tutti quanti*, to whom the casting of the Columbiad was a personal business. J.T. Maston constituted himself their cicerone; he did not excuse them any detail; he led them about everywhere, through the magazines, workshops, amongst the machines, and he forced them to visit the 1,200 furnaces one after the other. At the end of the 1,200th visit they were rather sick of it.

The casting was to take place precisely at twelve o’clock; the evening before each furnace had been charged with 114,000 lbs. of metal in bars disposed crossway to each other so that the warm air could circulate freely amongst them. Since early morning the 1,200 chimneys had been pouring forth volumes of flames into the atmosphere, and the soil was shaken convulsively. There were as many pounds of coal to be burnt as metal to be melted. There were, therefore, 68,000 tons of coal throwing up before the sun a thick curtain of black smoke.

The heat soon became unbearable in the circle of furnaces, the rambling of which resembled the rolling of thunder; powerful bellows added their continuous blasts, and saturated the incandescent furnaces with oxygen.

The operation of casting in order to succeed must be done rapidly. At a signal given by a cannon-shot each furnace was to pour out the liquid iron and to be entirely emptied.

These arrangements made, foremen and workmen awaited the preconcerted moment with impatience mixed with emotion. There was no longer any one in the inclosure, and each superintendent took his place near the aperture of the run.

Barbicane and his colleagues, installed on a neighbouring eminence, assisted at the operation. Before them a cannon was planted ready to be fired as a sign from the engineer.

A few minutes before twelve the first drops of metal began to run; the reservoirs were gradually filled, and when the iron was all in a liquid state it was left quiet for some instants in order to facilitate the separation of foreign substances.

Twelve o’clock struck. The cannon was suddenly fired, and shot its flame into the air. Twelve hundred tapping-holes were opened simultaneously, and twelve hundred fiery serpents crept along twelve hundred troughs towards the central well, rolling in rings of fire. There they

plunged with terrific noise down a depth of 900 feet. It was an exciting and magnificent spectacle. The ground trembled, whilst these waves of iron, throwing into the sky their clouds of smoke, evaporated at the same time the humidity of the mould, and hurled it upwards through the vent-holes of the masonry in the form of impenetrable vapour. These artificial clouds unrolled their thick spirals as they went up to a height of 3,000 feet into the air. Any Red Indian wandering upon the limits of the horizon might have believed in the formation of a new crater in the heart of Florida, and yet it was neither an irruption, nor a typhoon, nor a storm, nor a struggle of the elements, nor one of those terrible phenomena which Nature is capable of producing. No; man alone had produced those reddish vapours, those gigantic flames worthy of a volcano, those tremendous vibrations like the shock of an earthquake, those reverberations, rivals of hurricanes and storms, and it was his hand which hurled into an abyss, dug by himself, a whole Niagara of molten metal!

XVI. The Columbiad

Had the operation of casting succeeded? People were reduced to mere conjecture. However, there was every reason to believe in its success, as the mould had absorbed the entire mass of metal liquefied in the furnaces. Still it was necessarily a long time impossible to be certain.

In fact, when Major Rodman cast his cannon of 160,000 lbs., it took no less than a fortnight to cool. How long, therefore, would the monstrous Columbiad, crowned with its clouds of vapour, and guarded by its intense heat, be kept from the eyes of its admirers? It was difficult to estimate.

The impatience of the members of the Gun Club was put to a rude test during this lapse of time. But it could not be helped. J.T. Maston was nearly roasted through his anxiety. A fortnight after the casting an immense column of smoke was still soaring towards the sky, and the ground burnt the soles of the feet within a radius of 200 feet round the summit of Stony Hill.

The days went by; weeks followed them. There were no means of cooling the immense cylinder. It was impossible to approach it. The members of the Gun Club were obliged to wait with what patience they could muster.

“Here we are at the 10th of August,” said J.T. Maston one morning. “It wants hardly four months to the 1st of December! There still remains the interior mould to be taken out, and the Columbiad to be loaded! We never shall be ready! One cannot even approach the cannon! Will it never get cool? That would be a cruel deception!”

They tried to calm the impatient secretary without succeeding. Barbicane said nothing, but his silence covered serious irritation. To see himself stopped by an obstacle that time alone could remove—time, an enemy to be feared under the circumstances—and to be in the power of an enemy was hard for men of war.

However, daily observations showed a certain change in the state of the ground. Towards the 15th of August the vapour thrown off had notably diminished in intensity and thickness. A few days after the earth only exhaled a slight puff of smoke, the last breath of the monster shut up in its stone tomb. By degrees the vibrations of the ground ceased, and the circle of heat contracted; the most impatient of the spectators approached; one day they gained ten feet, the next twenty, and on the 22nd of August Barbicane, his colleagues, and the engineer could take their place on the cast-iron surface which covered the summit of Stony Hill, certainly a very healthy spot, where it was not yet allowed to have cold feet.

“At last!” cried the president of the Gun Club with an immense sigh of satisfaction.

The works were resumed the same day. The extraction of the interior mould was immediately proceeded with in order to clear out the bore; pickaxes, spades, and boring-tools were set to work without intermission; the clay and sand had become exceedingly hard under the action of the heat; but by the help of machines they cleared away the mixture still burning at its contact with the iron; the rubbish was rapidly carted away on the railway, and the work was done with such spirit, Barbicane’s intervention was so urgent, and his arguments, presented under the form of dollars, carried so much conviction, that on the 3rd of September all trace of the mould had disappeared.

The operation of boring was immediately begun; the boring-machines were set up without delay, and a few weeks later the interior surface of the immense tube was perfectly cylindrical, and the bore had acquired a high polish.

At last, on the 22nd of September, less than a year after the Barbicane communication, the enormous weapon, raised by means of delicate instruments, and quite vertical, was ready for use. There was nothing but the moon to wait for, but they were sure she would not fail.

J.T. Maston's joy knew no bounds, and he nearly had a frightful fall whilst looking down the tube of 900 feet. Without Colonel Blomsberry's right arm, which he had happily preserved, the secretary of the Gun Club, like a modern Erostatus, would have found a grave in the depths of the Columbiad.

The cannon was then finished; there was no longer any possible doubt as to its perfect execution; so on the 6th of October Captain Nicholl cleared off his debt to President Barbicane, who inscribed in his receipt-column a sum of 2,000 dollars. It may be believed that the captain's anger reached its highest pitch, and cost him an illness. Still there were yet three bets of 3,000, 4,000, and 5,000 dollars, and if he only gained 2,000, his bargain would not be a bad one, though not excellent. But money did not enter into his calculations, and the success obtained by his rival in the casting of a cannon against which iron plates sixty feet thick would not have resisted was a terrible blow to him.

Since the 23rd of September the inclosure on Stony Hill had been quite open to the public, and the concourse of visitors will be readily imagined.

In fact, innumerable people from all points of the United States flocked to Florida. The town of Tampa was prodigiously increased during that year, consecrated entirely to the works of the Gun Club; it then comprised a population of 150,000 souls. After having surrounded Fort Brooke in a network of streets it was now being lengthened out on that tongue of land which separated the two harbours of Espiritu-Santo Bay; new quarters, new squares, and a whole forest of houses had grown up in these formerly-deserted regions under the heat of the American sun. Companies were formed for the erection of churches, schools, private dwellings, and in less than a year the size of the town was increased tenfold.

It is well known that Yankees are born business men; everywhere that destiny takes them, from the glacial to the torrid zone, their instinct for business is usefully exercised. That is why simple visitors to Florida for the sole purpose of following the operations of the Gun Club allowed themselves to be involved in commercial operations as soon as they were installed in Tampa Town. The vessels freighted for the transport of the metal and the workmen had given unparalleled activity to the port. Soon other vessels of every form and tonnage, freighted with provisions and merchandise, ploughed the bay and the two harbours; vast offices of shipbrokers and merchants were established in the town, and the *Shipping Gazette* each day published fresh arrivals in the port of Tampa.

Whilst roads were multiplied round the town, in consequence of the prodigious increase in its population and commerce, it was joined by railway to the Southern States of the Union. One line of rails connected La Mobile to Pensacola, the great southern maritime arsenal; thence from that important point it ran to Tallahassee. There already existed there a short line, twenty-one miles long, to Saint Marks on the seashore. It was this loop-line that was prolonged as far as Tampa Town, awakening in its passage the dead or sleeping portions of Central Florida. Thus Tampa, thanks to these marvels of industry due to the idea born one line day in the brain of one man, could take as its right the airs of a large town. They surnamed it "Moon-City," and the capital of Florida suffered an eclipse visible from all points of the globe.

Every one will now understand why the rivalry was so great between Texas and Florida, and the irritation of the Texicans when they saw their pretensions set aside by the Gun Club. In their long-sighted sagacity they had foreseen what a country might gain from the experiment attempted by Barbicane, and the wealth that would accompany such a cannon-shot. Texas lost a vast centre of commerce, railways, and a considerable increase of population. All these advantages had been given to that miserable Floridian peninsula, thrown like a pier between the waves of the Gulf and those of the Atlantic Ocean. Barbicane, therefore, divided with General Santa-Anna the Texan antipathy.

However, though given up to its commercial and industrial fury, the new population of Tampa Town took care not to forget the interesting operations of the Gun Club. On the contrary, the least details of the enterprise, every blow of the pickaxe, interested them. There was an incessant flow of people to and from Tampa Town to Stony Hill—a perfect procession, or, better still, a pilgrimage.

It was already easy to foresee that the day of the experiment the concourse of spectators would be counted by millions, for they came already from all points of the earth to the narrow peninsula. Europe was emigrating to America.

But until then, it must be acknowledged, the curiosity of the numerous arrivals had only been moderately satisfied. Many counted upon seeing the casting who only saw the smoke from it. This was not much for hungry eyes, but Barbicane would allow no one to see that operation. Thereupon ensued grumbling, discontent, and murmurs; they blamed the president for what they considered dictatorial conduct. His act was stigmatised as “un-American.” There was nearly a riot round Stony Hill, but Barbicane was not to be moved. When, however, the Columbiad was quite finished, this state of closed doors could no longer be kept up; besides, it would have been in bad taste, and even imprudent, to offend public opinion. Barbicane, therefore, opened the inclosure to all comers; but, in accordance with his practical character, he determined to coin money out of the public curiosity.

It was, indeed, something to even be allowed to see this immense Columbiad, but to descend into its depths seemed to the Americans the *ne plus ultra* of earthly felicity. In consequence there was not one visitor who was not willing to give himself the pleasure of visiting the interior of this metallic abyss. Baskets hung from steam-cranes allowed them to satisfy their curiosity. It became a perfect mania. Women, children, and old men all made it their business to penetrate the mysteries of the colossal gun. The price for the descent was fixed at five dollars a head, and, notwithstanding this high charge, during the two months that preceded the experiment, the influx of visitors allowed the Gun Club to pocket nearly 500,000 dollars!

It need hardly be said that the first visitors to the Columbiad were the members of the Gun Club. This privilege was justly accorded to that illustrious body. The ceremony of reception took place on the 25th of September. A basket of honour took down the president, J.T. Maston, Major Elphinstone, General Morgan, Colonel Blomsberry, and other members of the Gun Club, ten in all. How hot they were at the bottom of that long metal tube! They were nearly stifled, but how delightful—how exquisite! A table had been laid for ten on the massive stone which formed the bottom of the Columbiad, and was lighted by a jet of electric light as bright as day itself. Numerous exquisite dishes, that seemed to descend from heaven, were successively placed before the guests, and the richest wines of France flowed profusely during this splendid repast, given 900 feet below the surface of the earth!

The festival was a gay, not to say a noisy one. Toasts were given and replied to. They drank to the earth and her satellite, to the Gun Club, the Union, the Moon, Diana, Phoebe, Selene, “the peaceful courier of the night.” All the hurrahs, carried up by the sonorous waves of the

immense acoustic tube, reached its mouth with a noise of thunder; then the multitude round Stony Hill heartily united their shouts to those of the ten revellers hidden from sight in the depths of the gigantic Columbiad.

J.T. Maston could contain himself no longer. Whether he shouted or ate, gesticulated or talked most would be difficult to determine. Any way he would not have given up his place for an empire, “not even if the cannon—loaded, primed, and fired at that very moment—were to blow him in pieces into the planetary universe.”

XVII. A Telegram

The great work undertaken by the Gun Club was now virtually ended, and yet two months would still elapse before the day the projectile would start for the moon. These two months would seem as long as two years to the universal impatience. Until then the smallest details of each operation had appeared in the newspapers every day, and were eagerly devoured by the public, but now it was to be feared that this “interest dividend” would be much diminished, and every one was afraid of no longer receiving his daily share of emotions.

They were all agreeably disappointed: the most unexpected, extraordinary, incredible, and improbable incident happened in time to keep up the general excitement to its highest pitch.

On September 30th, at 3.47 p.m., a telegram, transmitted through the Atlantic Cable, arrived at Tampa Town for President Barbicane.

He tore open the envelope and read the message, and, notwithstanding his great self-control, his lips grew pale and his eyes dim as he read the telegram.

The following is the text of the message stored in the archives of the Gun Club:—

“France, Paris,

“September 30th, 4 a.m.

“Barbicane, Tampa Town, Florida, United States.

“Substitute a cylindro-conical projectile for your spherical shell. Shall go inside. Shall arrive by steamer *Atlanta*.

“MICHEL ARDAN.”

XVIII. The Passenger Of The Atlanta

If this wonderful news, instead of coming by telegraph, had simply arrived by post and in a sealed envelope—if the French, Irish, Newfoundland, and American telegraph clerks had not necessarily been acquainted with it—Barbicane would not have hesitated for a moment. He would have been quite silent about it for prudence' sake, and in order not to throw discredit on his work. This telegram might be a practical joke, especially as it came from a Frenchman. What probability could there be that any man should conceive the idea of such a journey? And if the man did exist was he not a madman who would have to be inclosed in a strait-waistcoat instead of in a cannon-ball?

But the message was known, and Michel Ardan's proposition was already all over the States of the Union, so Barbicane had no reason for silence. He therefore called together his colleagues then in Tampa Town, and, without showing what he thought about it or saying a word about the degree of credibility the telegram deserved, he read coldly the laconic text.

"Not possible!"—"Unheard of!"—"They are laughing at us!"—"Ridiculous!"—"Absurd!" Every sort of expression for doubt, incredulity, and folly was heard for some minutes with accompaniment of appropriate gestures. J.T. Maston alone uttered the words:—

"That's an idea!" he exclaimed.

"Yes," answered the major, "but if people have such ideas as that they ought not to think of putting them into execution."

"Why not?" quickly answered the secretary of the Gun Club, ready for an argument. But the subject was let drop.

In the meantime Michel Ardan's name was already going about Tampa Town. Strangers and natives talked and joked together, not about the European—evidently a mythical personage—but about J.T. Maston, who had the folly to believe in his existence. When Barbicane proposed to send a projectile to the moon every one thought the enterprise natural and practicable—a simple affair of ballistics. But that a reasonable being should offer to go the journey inside the projectile was a farce, or, to use a familiar Americanism, it was all "humbug."

This laughter lasted till evening throughout the Union, an unusual thing in a country where any impossible enterprise finds adepts and partisans.

Still Michel Ardan's proposition did not fail to awaken a certain emotion in many minds. "They had not thought of such a thing." How many things denied one day had become realities the next! Why should not this journey be accomplished one day or another? But, any way, the man who would run such a risk must be a madman, and certainly, as his project could not be taken seriously, he would have done better to be quiet about it, instead of troubling a whole population with such ridiculous trash.

But, first of all, did this personage really exist? That was the great question. The name of "Michel Ardan" was not altogether unknown in America. It belonged to a European much talked about for his audacious enterprises. Then the telegram sent all across the depths of the Atlantic, the designation of the ship upon which the Frenchman had declared he had taken his passage, the date assigned for his arrival—all these circumstances gave to the proposition a certain air of probability. They were obliged to disburden their minds about it. Soon these isolated individuals formed into groups, the groups became condensed under the action of

curiosity like atoms by virtue of molecular attraction, and the result was a compact crowd going towards President Barbicane's dwelling.

The president, since the arrival of the message, had not said what he thought about it; he had let J.T. Maston express his opinions without manifesting either approbation or blame. He kept quiet, proposing to await events, but he had not taken public impatience into consideration, and was not very pleased at the sight of the population of Tampa Town assembled under his windows. Murmurs, cries, and vociferations soon forced him to appear. It will be seen that he had all the disagreeables as well as the duties of a public man.

He therefore appeared; silence was made, and a citizen asked him the following question:— "Is the person designated in the telegram as Michel Ardan on his way to America or not?"

"Gentlemen," answered Barbicane, "I know no more than you."

"We must get to know," exclaimed some impatient voices.

"Time will inform us," answered the president coldly.

"Time has no right to keep a whole country in suspense," answered the orator. "Have you altered your plans for the projectile as the telegram demanded?"

"Not yet, gentlemen; but you are right, we must have recourse to the telegraph that has caused all this emotion."

"To the telegraph-office!" cried the crowd.

Barbicane descended into the street, and, heading the immense assemblage, he went towards the telegraph-office.

A few minutes afterwards a telegram was on its way to the underwriters at Liverpool, asking for an answer to the following questions:—

"What sort of vessel is the *Atlanta*? When did she leave Europe? Had she a Frenchman named Michel Ardan on board?"

Two hours afterwards Barbicane received such precise information that doubt was no longer possible.

"The steamer *Atlanta*, from Liverpool, set sail on October 2nd for Tampa Town, having on board a Frenchman inscribed in the passengers' book as Michel Ardan."

At this confirmation of the first telegram the eyes of the president were lighted up with a sudden flame; he clenched his hands, and was heard to mutter—

"It is true, then! It is possible, then! the Frenchman does exist! and in a fortnight he will be here! But he is a madman! I never can consent."

And yet the very same evening he wrote to the firm of Breadwill and Co. begging them to suspend the casting of the projectile until fresh orders.

Now how can the emotion be described which took possession of the whole of America? The effect of the Barbicane proposition was surpassed tenfold; what the newspapers of the Union said, the way they accepted the news, and how they chanted the arrival of this hero from the old continent; how to depict the feverish agitation in which every one lived, counting the hours, minutes, and seconds; how to give even a feeble idea of the effect of one idea upon so many heads; how to show every occupation being given up for a single preoccupation, work stopped, commerce suspended, vessels, ready to start, waiting in the ports so as not to miss the arrival of the *Atlanta*, every species of conveyance arriving full and returning empty, the bay of Espiritu-Santo incessantly ploughed by steamers, packet-boats, pleasure-yachts, and

fly-boats of all dimensions; how to denominate in numbers the thousands of curious people who in a fortnight increased the population of Tampa Town fourfold, and were obliged to encamp under tents like an army in campaign—all this is a task above human force, and could not be undertaken without rashness.

At 9 a.m. on the 20th of October the semaphores of the Bahama Channel signalled thick smoke on the horizon. Two hours later a large steamer exchanged signals with them. The name *Atlanta* was immediately sent to Tampa Town. At 4 p.m. the English vessel entered the bay of Espiritu-Santo. At 5 p.m. she passed the entrance to Hillisboro Harbour, and at 6 p.m. weighed anchor in the port of Tampa Town.

The anchor had not reached its sandy bed before 500 vessels surrounded the *Atlanta* and the steamer was taken by assault. Barbicane was the first on deck, and in a voice the emotion of which he tried in vain to suppress—

“Michel Ardan!” he exclaimed.

“Present!” answered an individual mounted on the poop.

Barbicane, with his arms crossed, questioning eyes, and silent mouth, looked fixedly at the passenger of the *Atlanta*.

He was a man forty-two years of age, tall, but already rather stooping, like caryatides which support balconies on their shoulders. His large head shook every now and then a shock of red hair like a lion’s mane; a short face, wide forehead, a moustache bristling like a cat’s whiskers, and little bunches of yellow hair on the middle of his cheeks, round and rather wild-looking, short-sighted eyes completed this eminently feline physiognomy. But the nose was boldly cut, the mouth particularly humane, the forehead high, intelligent, and ploughed like a field that was never allowed to remain fallow. Lastly, a muscular body well poised on long limbs, muscular arms, powerful and well-set levers, and a decided gait made a solidly built fellow of this European, “rather wrought than cast,” to borrow one of his expressions from metallurgic art.

The disciples of Lavater or Gratiolet would have easily deciphered in the cranium and physiognomy of this personage indisputable signs of combativity—that is to say, of courage in danger and tendency to overcome obstacles, those of benevolence, and a belief in the marvellous, an instinct that makes many natures dwell much on superhuman things; but, on the other hand, the bumps of acquisivity, the need of possessing and acquiring, were absolutely wanting.

To put the finishing touches to the physical type of the passenger of the *Atlanta*, his garments wide, loose, and flowing, open cravat, wide collar, and cuffs always unbuttoned, through which came nervous hands. People felt that even in the midst of winter and dangers that man was never cold.

On the deck of the steamer, amongst the crowd, he bustled about, never still for a moment, “dragging his anchors,” in nautical speech, gesticulating, making friends with everybody, and biting his nails nervously. He was one of those original beings whom the Creator invents in a moment of fantasy, and of whom He immediately breaks the cast.

In fact, the character of Michel Ardan offered a large field for physiological analysis. This astonishing man lived in a perpetual disposition to hyperbole, and had not yet passed the age of superlatives; objects depicted themselves on the retina of his eye with exaggerated dimensions; from thence an association of gigantic ideas; he saw everything on a large scale except difficulties and men.

He was besides of a luxuriant nature, an artist by instinct, and witty fellow; he loved arguments *ad hominem*, and defended the weak side tooth and nail.

Amongst other peculiarities he gave himself out as “sublimely ignorant,” like Shakspeare, and professed supreme contempt for all *savants*, “people,” said he, “who only score our points.” He was, in short, a Bohemian of the country of brains, adventurous but not an adventurer, a harebrained fellow, a Phaeton running away with the horses of the sun, a kind of Icarus with relays of wings. He had a wonderful facility for getting into scrapes, and an equally wonderful facility for getting out of them again, falling on his feet like a cat.

In short, his motto was, “Whatever it may cost!” and the love of the impossible his “ruling passion,” according to Pope’s fine expression.

But this enterprising fellow had the defects of his qualities. Who risks nothing wins nothing, it is said. Ardan often risked much and got nothing. He was perfectly disinterested and chivalric; he would not have signed the death-warrant of his worst enemy, and would have sold himself into slavery to redeem a negro.

In France and Europe everybody knew this brilliant, bustling person. Did he not get talked of ceaselessly by the hundred voices of Fame, hoarse in his service? Did he not live in a glass house, taking the entire universe as confidant of his most intimate secrets? But he also possessed an admirable collection of enemies amongst those he had cuffed and wounded whilst using his elbows to make a passage in the crowd.

Still he was generally liked and treated like a spoiled child. Every one was interested in his bold enterprises, and followed them with uneasy mind. He was known to be so imprudent! When some friend wished to stop him by predicting an approaching catastrophe, “The forest is only burnt by its own trees,” he answered with an amiable smile, not knowing that he was quoting the prettiest of Arabian proverbs.

Such was the passenger of the *Atlanta*, always in a bustle, always boiling under the action of inward fire, always moved, not by what he had come to do in America—he did not even think about it—but on account of his feverish organisation. If ever individuals offered a striking contrast they were the Frenchman Michel Ardan and the Yankee Barbicane, both, however, enterprising, bold, and audacious, each in his own way.

Barbicane’s contemplation of his rival was quickly interrupted by the cheers of the crowd. These cries became even so frantic and the enthusiasm took such a personal form that Michel Ardan, after having shaken a thousand hands in which he nearly left his ten fingers, was obliged to take refuge in his cabin.

Barbicane followed him without having uttered a word.

“You are Barbicane?” Michel Ardan asked him as soon as they were alone, and in the same tone as he would have spoken to a friend of twenty years’ standing.

“Yes,” answered the president of the Gun Club.

“Well, good morning, Barbicane. How are you? Very well? That’s right! that’s right!”

“Then,” said Barbicane, without further preliminary, “you have decided to go?”

“Quite decided.”

“Nothing will stop you?”

“Nothing. Have you altered your projectile as I told you in my message?”

“I waited till you came. But,” asked Barbicane, insisting once more, “you have quite reflected?”

“Reflected! have I any time to lose? I find the occasion to go for a trip to the moon, I profit by it, and that is all. It seems to me that does not want so much reflection.”

Barbicane looked eagerly at the man who spoke of his project of journey with so much carelessness, and with such absence of anxiety.

“But at least,” he said, “you have some plan, some means of execution?”

“Excellent means. But allow me to tell you one thing. I like to say my say once and for all, and to everybody, and to hear no more about it. Then, unless you can think of something better, call together your friends, your colleagues, all the town, all Florida, all America if you like, and to-morrow I shall be ready to state my means of execution, and answer any objections, whatever they may be. Will that do?”

“Yes, that will do,” answered Barbicane.

Whereupon the president left the cabin, and told the crowd about Michel Ardan’s proposition. His words were received with great demonstrations of joy. That cut short all difficulties. The next day every one could contemplate the European hero at their ease. Still some of the most obstinate spectators would not leave the deck of the *Atlanta*; they passed the night on board. Amongst others, J.T. Maston had screwed his steel hook into the combing of the poop, and it would have taken the capstan to get it out again.

“He is a hero! a hero!” cried he in every tone, “and we are only old women compared to that European!”

As to the president, after having requested the spectators to withdraw, he re-entered the passenger’s cabin, and did not leave it till the bell of the steamer rang out the midnight quarter.

But then the two rivals in popularity shook each other warmly by the hand, and separated friends.

XIX. A Meeting

The next day the sun did not rise early enough to satisfy public impatience. Barbicane, fearing that indiscreet questions would be put to Michel Ardan, would like to have reduced his auditors to a small number of adepts, to his colleagues for instance. But it was as easy as to dam up the Falls at Niagara. He was, therefore, obliged to renounce his project, and let his friend run all the risks of a public lecture. The new Town Hall of Tampa Town, notwithstanding its colossal dimensions, was considered insufficient for the occasion, which had assumed the proportions of a public meeting.

The place chosen was a vast plain, situated outside the town. In a few hours they succeeded in sheltering it from the rays of the sun. The ships of the port, rich in canvas, furnished the necessary accessories for a colossal tent. Soon an immense sky of cloth was spread over the calcined plain, and defended it against the heat of the day. There 300,000 persons stood and braved a stifling temperature for several hours whilst awaiting the Frenchman's arrival. Of that crowd of spectators one-third alone could see and hear; a second third saw badly, and did not hear. As to the remaining third, it neither heard nor saw, though it was not the least eager to applaud.

At three o'clock Michel Ardan made his appearance, accompanied by the principal members of the Gun Club. He gave his right arm to President Barbicane, and his left to J.T. Maston, more radiant than the midday sun, and nearly as ruddy.

Ardan mounted the platform, from which his eyes extended over a forest of black hats. He did not seem in the least embarrassed; he did not pose; he was at home there, gay, familiar, and amiable. To the cheers that greeted him he answered by a gracious bow; then with his hand asked for silence, began to speak in English, and expressed himself very correctly in these terms:—

"Gentlemen," said he, "although it is very warm, I intend to keep you a few minutes to give you some explanation of the projects which have appeared to interest you. I am neither an orator nor a *savant*, and I did not count upon having to speak in public; but my friend Barbicane tells me it would give you pleasure, so I do it. Then listen to me with your 600,000 ears, and please to excuse the faults of the orator."

This unceremonious beginning was much admired by the audience, who expressed their satisfaction by an immense murmur of applause.

"Gentlemen," said he, "no mark of approbation or dissent is prohibited. That settled, I continue. And, first of all, do not forget that you have to do with an ignorant man, but his ignorance goes far enough to ignore difficulties. It has, therefore, appeared a simple, natural, and easy thing to him to take his passage in a projectile and to start for the moon. That journey would be made sooner or later, and as to the mode of locomotion adopted, it simply follows the law of progress. Man began by travelling on all fours, then one fine day he went on two feet, then in a cart, then in a coach, then on a railway. Well, the projectile is the carriage of the future, and, to speak the truth, planets are only projectiles, simple cannon-balls hurled by the hand of the Creator. But to return to our vehicle. Some of you, gentlemen, may think that the speed it will travel at is excessive—nothing of the kind. All the planets go faster, and the earth itself in its movement round the sun carries us along three times as fast. Here are some examples. Only I ask your permission to express myself in leagues, for

American measures are not very familiar to me, and I fear getting muddled in my calculations."

The demand appeared quite simple, and offered no difficulty. The orator resumed his speech.

"The following, gentlemen, is the speed of the different planets. I am obliged to acknowledge that, notwithstanding my ignorance, I know this small astronomical detail exactly, but in two minutes you will be as learned as I. Learn, then, that Neptune goes at the rate of 5,000 leagues an hour; Uranus, 7,000; Saturn, 8,858; Jupiter, 11,675; Mars, 22,011; the earth, 27,500; Venus, 32,190; Mercury, 52,520; some comets, 14,000 leagues in their perihelion! As to us, veritable idlers, people in no hurry, our speed does not exceed 9,900 leagues, and it will go on decreasing! I ask you if there is anything to wonder at, and if it is not evident that it will be surpassed some day by still greater speeds, of which light or electricity will probably be the mechanical agents?"

No one seemed to doubt this affirmation.

"Dear hearers," he resumed, "according to certain narrow minds—that is the best qualification for them—humanity is inclosed in a Popilius circle which it cannot break open, and is condemned to vegetate upon this globe without ever flying towards the planetary shores! Nothing of the kind! We are going to the moon, we shall go to the planets, we shall go to the stars as we now go from Liverpool to New York, easily, rapidly, surely, and the atmospheric ocean will be as soon crossed as the oceans of the earth! Distance is only a relative term, and will end by being reduced to zero."

The assembly, though greatly in favour of the French hero, was rather staggered by this audacious theory. Michel Ardan appeared to see it.

"You do not seem convinced, my worthy hosts," he continued with an amiable smile. "Well, let us reason a little. Do you know how long it would take an express train to reach the moon? Three hundred days. Not more. A journey of 86,410 leagues, but what is that? Not even nine times round the earth, and there are very few sailors who have not done that during their existence. Think, I shall be only ninety-eight hours on the road! Ah, you imagine that the moon is a long way from the earth, and that one must think twice before attempting the adventure! But what would you say if I were going to Neptune, which gravitates at 1,147,000,000 leagues from the sun? That is a journey that very few people could go, even if it only cost a farthing a mile! Even Baron Rothschild would not have enough to take his ticket!"

This argument seemed greatly to please the assembly; besides, Michel Ardan, full of his subject, grew superbly eloquent; he felt he was listened to, and resumed with admirable assurance—

"Well, my friends, this distance from Neptune to the sun is nothing compared to that of the stars, some of which are billions of leagues from the sun! And yet people speak of the distance that separates the planets from the sun! Do you know what I think of this universe that begins with the sun and ends at Neptune? Should you like to know my theory? It is a very simple one. According to my opinion, the solar universe is one solid homogeneous mass; the planets that compose it are close together, crowd one another, and the space between them is only the space that separates the molecules of the most compact metal—silver, iron, or platinum! I have, therefore, the right to affirm, and I will repeat it with a conviction you will all share—distance is a vain word; distance does not exist!"

"Well said! Bravo! Hurrah!" cried the assembly with one voice, electrified by the gesture and accent of the orator, and the boldness of his conceptions.

“No!” cried J.T. Maston, more energetically than the others; “distance does not exist!”

And, carried away by the violence of his movements and emotions he could hardly contain, he nearly fell from the top of the platform to the ground. But he succeeded in recovering his equilibrium, and thus avoided a fall that would have brutally proved distance not to be a vain word. Then the speech of the distinguished orator resumed its course.

“My friends,” said he, “I think that this question is now solved. If I have not convinced you all it is because I have been timid in my demonstrations, feeble in my arguments, and you must set it down to my theoretic ignorance. However that may be, I repeat, the distance from the earth to her satellite is really very unimportant and unworthy to occupy a serious mind. I do not think I am advancing too much in saying that soon a service of trains will be established by projectiles, in which the journey from the earth to the moon will be comfortably accomplished. There will be no shocks nor running off the lines to fear, and the goal will be reached rapidly, without fatigue, in a straight line, ‘as the crow flies.’ Before twenty years are over, half the earth will have visited the moon!”

“Three cheers for Michel Ardan!” cried the assistants, even those least convinced.

“Three cheers for Barbicane!” modestly answered the orator.

This act of gratitude towards the promoter of the enterprise was greeted with unanimous applause.

“Now, my friends,” resumed Michel Ardan, “if you have any questions to ask me you will evidently embarrass me, but still I will endeavour to answer you.”

Until now the president of the Gun Club had reason to be very satisfied with the discussion. It had rolled upon speculative theories, upon which Michel Ardan, carried away by his lively imagination, had shown himself very brilliant. He must, therefore, be prevented from deviating towards practical questions, which he would doubtless not come out of so well. Barbicane made haste to speak, and asked his new friend if he thought that the moon or the planets were inhabited.

“That is a great problem, my worthy president,” answered the orator, smiling; “still, if I am not mistaken, men of great intelligence—Plutarch, Swedenborg, Bernardin de Saint-Pierre, and many others—answered in the affirmative. If I answered from a natural philosophy point of view I should do the same—I should say to myself that nothing useless exists in this world, and, answering your question by another, friend Barbicane, I should affirm that if the planets are inhabitable, either they are inhabited, they have been, or they will be.”

“Very well,” cried the first ranks of spectators, whose opinion had the force of law for the others.

“It is impossible to answer with more logic and justice,” said the president of the Gun Club. “The question, therefore, comes to this: ‘Are the planets inhabitable?’ I think so, for my part.”

“And I—I am certain of it,” answered Michel Ardan.

“Still,” replied one of the assistants, “there are arguments against the inhabitability of the worlds. In most of them it is evident that the principles of life must be modified. Thus, only to speak of the planets, the people must be burnt up in some and frozen in others according as they are a long or short distance from the sun.”

“I regret,” answered Michel Ardan, “not to know my honourable opponent personally. His objection has its value, but I think it may be combated with some success, like all those of

which the habitability of worlds has been the object. If I were a physician I should say that if there were less caloric put in motion in the planets nearest to the sun, and more, on the contrary, in the distant planets, this simple phenomenon would suffice to equalise the heat and render the temperature of these worlds bearable to beings organised like we are. If I were a naturalist I should tell him, after many illustrious *savants*, that Nature furnishes us on earth with examples of animals living in very different conditions of habitability; that fish breathe in a medium mortal to the other animals; that amphibians have a double existence difficult to explain; that certain inhabitants of the sea live in the greatest depths, and support there, without being crushed, pressures of fifty or sixty atmospheres; that some aquatic insects, insensible to the temperature, are met with at the same time in springs of boiling water and in the frozen plains of the Polar Ocean—in short, there are in nature many means of action, often incomprehensible, but no less real. If I were a chemist I should say that aërolites—bodies evidently formed away from our terrestrial globe—have when analysed, revealed indisputable traces of carbon, a substance that owes its origin solely to organised beings, and which, according to Reichenbach's experiments, must necessarily have been 'animalised.' Lastly, if I were a theologian I should say that Divine Redemption, according to St. Paul, seems applicable not only to the earth but to all the celestial bodies. But I am neither a theologian, chemist, naturalist, nor natural philosopher. So, in my perfect ignorance of the great laws that rule the universe, I can only answer, 'I do not know if the heavenly bodies are inhabited, and, as I do not know, I am going to see!'"

Did the adversary of Michel Ardan's theories hazard any further arguments? It is impossible to say, for the frantic cries of the crowd would have prevented any opinion from being promulgated. When silence was again restored, even in the most distant groups, the triumphant orator contented himself with adding the following considerations:—

"You will think, gentlemen, that I have hardly touched upon this grave question. I am not here to give you an instructive lecture upon this vast subject. There is another series of arguments in favour of the heavenly bodies being inhabited; I do not look upon that. Allow me only to insist upon one point. To the people who maintain that the planets are not inhabited you must answer, 'You may be right if it is demonstrated that the earth is the best of possible worlds; but it is not so, notwithstanding Voltaire.' It has only one satellite, whilst Jupiter, Uranus, Saturn, and Neptune have several at their service, an advantage that is not to be disdained. But that which now renders the earth an uncomfortable place of abode is the inclination of its axis upon its orbit. Hence the inequality of day and night; hence the unfortunate diversity of seasons. Upon our miserable spheroid it is always either too warm or too cold; we are frozen in winter and roasted in summer; it is the planet of colds, rheumatism, and consumption, whilst on the surface of Jupiter, for instance, where the axis has only a very slight inclination, the inhabitants can enjoy invariable temperature. There is the perpetual spring, summer, autumn, and winter zone; each 'Jovian' may choose the climate that suits him, and may shelter himself all his life from the variations of the temperature. You will doubtless agree to this superiority of Jupiter over our planet without speaking of its years, which each lasts twelve years! What is more, it is evident to me that, under these auspices, and under such marvellous conditions of existence, the inhabitants of that fortunate world are superior beings—that *savants* are more learned, artists more artistic, the wicked less wicked, and the good are better. Alas! what is wanting to our spheroid to reach this perfection is very little!—an axis of rotation less inclined on the plane of its orbit."

"Well!" cried an impetuous voice, "let us unite our efforts, invent machines, and rectify the earth's axis!"

Thunders of applause greeted this proposition, the author of which could be no other than J.T. Maston. It is probable that the fiery secretary had been carried away by his instincts as engineer to venture such a proposition; but it must be said, for it is the truth, many encouraged him with their cries, and doubtless, if they had found the resting-point demanded by Archimedes, the Americans would have constructed a lever capable of raising the world and redressing its axis. But this point was wanting to these bold mechanicians.

Nevertheless, this eminently practical idea had enormous success: the discussion was suspended for a good quarter of an hour, and long, very long afterwards, they talked in the United States of America of the proposition so energetically enunciated by the perpetual secretary of the Gun Club.

XX. Thrust And Parry

This incident seemed to have terminated the discussion, but when the agitation had subsided these words were heard uttered in a loud and severe voice:—

“Now that the orator has allowed his fancy to roam, perhaps he would kindly go back to his subject, pay less attention to theories, and discuss the practical part of his expedition.”

All eyes were turned towards the person who spoke thus. He was a thin, dry-looking man, with an energetic face and an American beard. By taking advantage of the agitation in the assembly from time to time he had gained, by degrees, the front row of spectators. There, with his arms crossed, his eyes brilliant and bold, he stared imperturbably at the hero of the meeting. After having asked his question he kept silence, and did not seem disturbed by the thousands of eyes directed towards him nor by the disapproving murmur excited by his words. The answer being delayed he again put the question with the same clear and precise accent; then he added—

“We are here to discuss the moon, not the earth.”

“You are right, sir,” answered Michel Ardan, “the discussion has wandered from the point; we will return to the moon.”

“Sir,” resumed the unknown man, “you pretend that our satellite is inhabited. So far so good; but if Selenites do exist they certainly live without breathing, for—I tell you the fact for your good—there is not the least particle of air on the surface of the moon.”

At this affirmation Ardan shook his red mane; he understood that a struggle was coming with this man on the real question. He looked at him fixedly in his turn, and said—

“Ah! there is no air in the moon! And who says so, pray?”

“The *savants*.”

“Indeed?”

“Indeed.”

“Sir,” resumed Michel, “joking apart, I have a profound respect for *savants* who know, but a profound contempt for *savants* who do not know.”

“Do you know any who belong to the latter category?”

“Yes; in France there is one who maintains that, ‘mathematically,’ a bird cannot fly, and another who demonstrates that a fish is not made to live in water.”

“There is no question of those two, sir, and I can quote in support of my proposition names that you will not object to.”

“Then, sir, you would greatly embarrass a poor ignorant man like me!”

“Then why do you meddle with scientific questions which you have never studied?” asked the unknown brutally.

“Why?” answered Ardan; “because the man who does not suspect danger is always brave! I know nothing, it is true, but it is precisely my weakness that makes my strength.”

“Your weakness goes as far as madness,” exclaimed the unknown in a bad-tempered tone.

“So much the better,” replied the Frenchman, “if my madness takes me to the moon!”

Barbicane and his colleagues stared at the intruder who had come so boldly to stand in the way of their enterprise. None of them knew him, and the president, not reassured upon the upshot of such a discussion, looked at his new friend with some apprehension. The assembly was attentive and slightly uneasy, for this struggle called attention to the dangers and impossibilities of the expedition.

“Sir,” resumed Michel Ardan’s adversary, “the reasons that prove the absence of all atmosphere round the moon are numerous and indisputable. I may say, even, that, *à priori* if that atmosphere had ever existed, it must have been drawn away by the earth, but I would rather oppose you with incontestable facts.”

“Oppose, sir,” answered Michel Ardan, with perfect gallantry—oppose as much as you like.”

“You know,” said the unknown, “that when the sun’s rays traverse a medium like air they are deviated from a straight line, or, in other words, they are refracted. Well, when stars are occulted by the moon their rays, on grazing the edge of her disc, do not show the least deviation nor offer the slightest indication of refraction. It follows, therefore, that the moon can have no atmosphere.”

Every one looked at the Frenchman, for, this once admitted, the consequences were rigorous.

“In fact,” answered Michel Ardan, “that is your best if not only argument, and a *savant*, perhaps, would be embarrassed to answer it. I can only tell you that this argument has no absolute value because it supposes the angular diameter of the moon to be perfectly determined, which it is not. But let us waive that, and tell me, my dear sir, if you admit the existence of volcanoes on the surface of the moon.”

“Extinct volcanoes, yes; volcanoes in eruption, no.”

“For the sake of argument let us suppose that these volcanoes have been in eruption for a certain period.”

“That is certain, but as they can themselves furnish the oxygen necessary for combustion the fact of their eruption does not in the least prove the presence of a lunar atmosphere.”

“We will pass on, then,” answered Michel Ardan, “and leave this series of argument and arrive at direct observation. But I warn you that I am going to quote names.”

“Very well.”

“In 1715 the astronomers Louville and Halley, observing the eclipse of the 3rd of May, remarked certain fulminations of a remarkable nature. These jets of light, rapid and frequent, were attributed by them to storms in the atmosphere of the moon.”

“In 1715,” replied the unknown, “the astronomers Louville and Halley took for lunar phenomena phenomena purely terrestrial, such as meteoric or other bodies which are generated in our own atmosphere. That was the scientific aspect of these facts, and I go with it.”

“Let us pass on again,” answered Ardan, without being confused by the reply. “Did not Herschel, in 1787, observe a great number of luminous points on the surface of the moon?”

“Certainly; but without explaining the origin of these luminous points. Herschel himself did not thereby conclude the necessity of a lunar atmosphere.”

“Well answered,” said Michel Ardan, complimenting his adversary; “I see that you are well up in selenography.”

“Yes, sir; and I may add that the most skilful observers, MM. Boeer and Moedler, agree that air is absolutely wanting on the moon’s surface.”

A movement took place amongst the audience, who appeared struck by the arguments of this singular personage.

“We will pass on again,” answered Michel Ardan, with the greatest calmness, “and arrive now at an important fact. A skilful French astronomer, M. Laussedat, whilst observing the eclipse of July 18th, 1860, proved that the horns of the solar crescent were rounded and truncated. Now this appearance could only have been produced by a deviation of the solar rays in traversing the atmosphere of the moon. There is no other possible explanation of the fact.”

“But is this fact authenticated?”

“It is absolutely certain.”

An inverse movement brought back the audience to the side of their favourite hero, whose adversary remained silent.

Ardan went on speaking without showing any vanity about his last advantage; he said simply—

“You see, therefore, my dear sir, that it cannot be positively affirmed that there is no atmosphere on the surface of the moon. This atmosphere is probably not dense, but science now generally admits that it exists.”

“Not upon the mountains,” replied the unknown, who would not give in.

“No, but in the depths of the valleys, and it is not more than some hundreds of feet deep.”

“Any way you will do well to take your precautions, for the air will be terribly rarefied.”

“Oh, there will always be enough for one man. Besides, once delivered up there, I shall do my best to economise it and only to breathe it on great occasions.”

A formidable burst of laughter saluted the mysterious interlocutor, who looked round the assembly daring it proudly.

“Then,” resumed Michel Ardan, carelessly, “as we are agreed upon the presence of some atmosphere, we are forced to admit the presence of some water—a consequence I am delighted with, for my part. Besides, I have another observation to make. We only know one side of the moon’s disc, and if there is little air on that side there may be much on the other.”

“How so?”

“Because the moon under the action of terrestrial attraction has assumed the form of an egg, of which we see the small end. Hence the consequence due to the calculations of Hausen, that its centre of gravity is situated in the other hemisphere. Hence this conclusion that all the masses of air and water have been drawn to the other side of our satellite in the first days of the creation.”

“Pure fancies,” exclaimed the unknown.

“No, pure theories based upon mechanical laws, and it appears difficult to me to refute them. I make appeal to this assembly and put it to the vote to know if life such as it exists upon earth is possible on the surface of the moon?”

Three hundred thousand hearers applauded this proposition. Michel Ardan's adversary wished to speak again, but he could not make himself heard. Cries and threats were hailed upon him.

"Enough, enough!" said some.

"Turn him out!" repeated others.

But he, holding on to the platform, did not move, and let the storm pass by. It might have assumed formidable proportions if Michel Ardan had not appeased it by a gesture. He was too chivalrous to abandon his contradicter in such an extremity.

"You wish to add a few words?" he asked, in the most gracious tone.

"Yes, a hundred! a thousand!" answered the unknown, carried away, "or rather no, one only! To persevere in your enterprise you must be—"

"Imprudent! How can you call me that when I have asked for a cylindro-conical bullet from my friend Barbicane so as not to turn round on the road like a squirrel?"

"But, unfortunate man! the fearful shock will smash you to pieces when you start."

"You have there put your finger upon the real and only difficulty; but I have too good an opinion of the industrial genius of the Americans to believe that they will not overcome that difficulty."

"But the heat developed by the speed of the projectile whilst crossing the beds of air?"

"Oh, its sides are thick, and I shall so soon pass the atmosphere."

"But provisions? water?"

"I have calculated that I could carry enough for one year, and I shall only be four days going."

"But air to breathe on the road?"

"I shall make some by chemical processes."

"But your fall upon the moon, supposing you ever get there?"

"It will be six times less rapid than a fall upon the earth, as attraction is six times less on the surface of the moon."

"But it still will be sufficient to smash you like glass."

"What will prevent me delaying my fall by means of rockets conveniently placed and lighted at the proper time?"

"But lastly, supposing that all difficulties be solved, all obstacles cleared away by uniting every chance in your favour, admitting that you reach the moon safe and well, how shall you come back?"

"I shall not come back."

Upon this answer, which was almost sublime by reason of its simplicity, the assembly remained silent. But its silence was more eloquent than its cries of enthusiasm would have been. The unknown profited by it to protest one last time.

"You will infallibly kill yourself," he cried, "and your death, which will be only a madman's death, will not even be useful to science."

"Go on, most generous of men, for you prophesy in the most agreeable manner."

“Ah, it is too much!” exclaimed Michel Ardan’s adversary, “and I do not know why I go on with so childish a discussion. Go on with your mad enterprise as you like. It is not your fault.”

“Fire away.”

“No, another must bear the responsibility of your acts.”

“Who is that, pray?” asked Michel Ardan in an imperious voice.

“The fool who has organised this attempt, as impossible as it is ridiculous.”

The attack was direct. Barbicane since the intervention of the unknown had made violent efforts to contain himself and “consume his own smoke,” but upon seeing himself so outrageously designated he rose directly and was going to walk towards his adversary, who dared him to his face, when he felt himself suddenly separated from him.

The platform was lifted up all at once by a hundred vigorous arms, and the president of the Gun Club was forced to share the honours of triumph with Michel Ardan. The platform was heavy, but the bearers came in continuous relays, disputing, struggling, even fighting for the privilege of lending the support of their shoulders to this manifestation.

However, the unknown did not take advantage of the tumult to leave the place. He kept in the front row, his arms folded, still staring at President Barbicane.

The president did not lose sight of him either, and the eyes of these two men met like flaming swords.

The cries of the immense crowds kept at their maximum of intensity during this triumphant march. Michel Ardan allowed himself to be carried with evident pleasure.

Sometimes the platform pitched and tossed like a ship beaten by the waves. But the two heroes of the meeting were good sailors, and their vessel safely arrived in the port of Tampa Town.

Michel Ardan happily succeeded in escaping from his vigorous admirers. He fled to the Franklin Hotel, quickly reached his room, and glided rapidly into bed whilst an army of 100,000 men watched under his windows.

In the meanwhile a short, grave, and decisive scene had taken place between the mysterious personage and the president of the Gun Club.

Barbicane, liberated at last, went straight to his adversary.

“Come!” said he in a curt voice.

The stranger followed him on to the quay, and they were soon both alone at the entrance to a wharf opening on to Jones’ Fall.

There these enemies, still unknown to one another, looked at each other.

“Who are you?” asked Barbicane.

“Captain Nicholl.”

“I thought so. Until now fate has never made you cross my path.”

“I crossed it of my own accord.”

“You have insulted me.”

“Publicly.”

“And you shall give me satisfaction for that insult.”

“Now, this minute.”

“No. I wish everything between us to be kept secret. There is a wood situated three miles from Tampa—Skersnaw Wood. Do you know it?”

“Yes.”

“Will you enter it to-morrow morning at five o’clock by one side?”

“Yes, if you will enter it by the other at the same time.”

“And you will not forget your rifle?” said Barbicane.

“Not more than you will forget yours,” answered Captain Nicholl.

After these words had been coldly pronounced the president of the Gun Club and the captain separated. Barbicane returned to his dwelling; but, instead of taking some hours’ rest, he passed the night in seeking means to avoid the shock of the projectile, and to solve the difficult problem given by Michel Ardan at the meeting.

XXI. How A Frenchman Settles An Affair

Whilst the duel was being discussed between the president and the captain—a terrible and savage duel in which each adversary became a man-hunter—Michel Ardan was resting after the fatigues of his triumph. Resting is evidently not the right expression, for American beds rival in hardness tables of marble or granite.

Ardan slept badly, turning over and over between the *serviettes* that served him for sheets, and he was thinking of installing a more comfortable bed in his projectile when a violent noise startled him from his slumbers. Thundering blows shook his door. They seemed to be administered with an iron instrument. Shouts were heard in this racket, rather too early to be agreeable.

“Open!” some one cried. “Open, for Heaven’s sake!”

There was no reason why Ardan should acquiesce in so peremptory a demand. Still he rose and opened his door at the moment it was giving way under the efforts of the obstinate visitor.

The secretary of the Gun Club bounded into the room. A bomb would not have entered with less ceremony.

“Yesterday evening,” exclaimed J.T. Maston *ex abrupto*, “our president was publicly insulted during the meeting! He has challenged his adversary, who is no other than Captain Nicholl! They are going to fight this morning in Skersnaw Wood! I learnt it all from Barbicane himself! If he is killed our project will be at an end! This duel must be prevented! Now one man only can have enough empire over Barbicane to stop it, and that man is Michel Ardan.”

Whilst J.T. Maston was speaking thus, Michel Ardan, giving up interrupting him, jumped into his vast trousers, and in less than two minutes after the two friends were rushing as fast as they could go towards the suburbs of Tampa Town.

It was during this rapid course that Maston told Ardan the state of the case. He told him the real causes of the enmity between Barbicane and Nicholl, how that enmity was of old date, why until then, thanks to mutual friends, the president and the captain had never met; he added that it was solely a rivalry between iron-plate and bullet; and, lastly, that the scene of the meeting had only been an occasion long sought by Nicholl to satisfy an old grudge.

There is nothing more terrible than these private duels in America, during which the two adversaries seek each other across thickets, and hunt each other like wild animals. It is then that each must envy those marvellous qualities so natural to the Indians of the prairies, their rapid intelligence, their ingenious ruse, their scent of the enemy. An error, a hesitation, a wrong step, may cause death. In these meetings the Yankees are often accompanied by their dogs, and both sportsmen and game go on for hours.

“What demons you are!” exclaimed Michel Ardan, when his companion had depicted the scene with much energy.

“We are what we are,” answered J.T. Maston modestly; “but let us make haste.”

In vain did Michel Ardan and he rush across the plain still wet with dew, jump the creeks, take the shortest cuts; they could not reach Skersnaw Wood before half-past five. Barbicane must have entered it half-an-hour before.

There an old bushman was tying up faggots his axe had cut.

Maston ran to him crying—

“Have you seen a man enter the wood armed with a rifle? Barbicane, the president—my best friend?”

The worthy secretary of the Gun Club thought naïvely that all the world must know his president. But the bushman did not seem to understand.

“A sportsman,” then said Ardan.

“A sportsman? Yes,” answered the bushman.

“Is it long since?”

“About an hour ago.”

“Too late!” exclaimed Maston.

“Have you heard any firing?” asked Michel Ardan.

“No.”

“Not one shot?”

“Not one. That sportsman does not seem to bag much game!”

“What shall we do?” said Maston.

“Enter the wood at the risk of catching a bullet not meant for us.”

“Ah!” exclaimed Maston, with an unmistakable accent, “I would rather have ten bullets in my head than one in Barbicane’s head.”

“Go ahead, then!” said Ardan, pressing his companion’s hand.

A few seconds after the two companions disappeared in a copse. It was a dense thicket made of huge cypresses, sycamores, tulip-trees, olives, tamarinds, oaks, and magnolias. The different trees intermingled their branches in inextricable confusion, and quite hid the view. Michel Ardan and Maston walked on side by side phasing silently through the tall grass, making a road for themselves through the vigorous creepers, looking in all the bushes or branches lost in the sombre shade of the foliage, and expecting to hear a shot at every step. As to the traces that Barbicane must have left of his passage through the wood, it was impossible for them to see them, and they marched blindly on in the hardly-formed paths in which an Indian would have followed his adversary step by step.

After a vain search of about an hour’s length the two companions stopped. Their anxiety was redoubled.

“It must be all over,” said Maston in despair. “A man like Barbicane would not lay traps or condescend to any manoeuvre! He is too frank, too courageous. He has gone straight into danger, and doubtless far enough from the bushman for the wind to carry off the noise of the shot!”

“But we should have heard it!” answered Michel Ardan.

“But what if we came too late?” exclaimed J.T. Maston in an accent of despair.

Michel Ardan did not find any answer to make. Maston and he resumed their interrupted walk. From time to time they shouted; they called either Barbicane or Nicholl; but neither of the two adversaries answered. Joyful flocks of birds, roused by the noise, disappeared amongst the branches, and some frightened deer fled through the copses.

They continued their search another hour. The greater part of the wood had been explored. Nothing revealed the presence of the combatants. They began to doubt the affirmation of the bushman, and Ardan was going to renounce the pursuit as useless, when all at once Maston stopped.

“Hush!” said he. “There is some one yonder!”

“Some one?” answered Michel Ardan.

“Yes! a man! He does not seem to move. His rifle is not in his hand. What can he be doing?”

“But do you recognise him?” asked Michel Ardan.

“Yes, yes! he is turning round,” answered Maston.

“Who is it?”

“Captain Nicholl!”

“Nicholl!” cried Michel Ardan, whose heart almost stopped beating.

“Nicholl disarmed! Then he had nothing more to fear from his adversary?”

“Let us go to him,” said Michel Ardan; “we shall know how it is.”

But his companion and he had not gone fifty steps when they stopped to examine the captain more attentively. They imagined they should find a bloodthirsty and revengeful man. Upon seeing him they remained stupefied.

A net with fine meshes was hung between two gigantic tulip-trees, and in it a small bird, with its wings entangled, was struggling with plaintive cries. The bird-catcher who had hung the net was not a human being but a venomous spider, peculiar to the country, as large as a pigeon’s egg, and furnished with enormous legs. The hideous insect, as he was rushing on his prey, was forced to turn back and take refuge in the high branches of a tulip-tree, for a formidable enemy threatened him in his turn.

In fact, Captain Nicholl, with his gun on the ground, forgetting the dangers of his situation, was occupied in delivering as delicately as possible the victim taken in the meshes of the monstrous spider. When he had finished he let the little bird fly away; it fluttered its wings joyfully and disappeared.

Nicholl, touched, was watching it fly through the copse when he heard these words uttered in a voice full of emotion:—

“You are a brave man, you are!”

He turned. Michel Ardan was in front of him, repeating in every tone—

“And a kind one!”

“Michel Ardan!” exclaimed the captain, “what have you come here for, sir?”

“To shake hands with you, Nicholl, and prevent you killing Barbicane or being killed by him.”

“Barbicane!” cried the captain, “I have been looking for him these two hours without finding him! Where is he hiding himself?”

“Nicholl!” said Michel Ardan, “this is not polite! You must always respect your adversary; don’t be uneasy; if Barbicane is alive we shall find him, and so much the more easily that if he has not amused himself with protecting birds he must be looking for you too. But when you have found him—and Michel Ardan tells you this—there will be no duel between you.”

“Between President Barbicane and me,” answered Nicholl gravely, “there is such rivalry that the death of one of us—”

“Come, come!” resumed Michel Ardan, “brave men like you may detest one another, but they respect one another too. You will not fight.”

“I shall fight, sir.”

“No you won’t.”

“Captain,” then said J.T. Maston heartily, “I am the president’s friend, his *alter ego*; if you must absolutely kill some one kill me; that will be exactly the same thing.”

“Sir,” said Nicholl, convulsively seizing his rifle, “this joking—”

“Friend Maston is not joking,” answered Michel Ardan, “and I understand his wanting to be killed for the man he loves; but neither he nor Barbicane will fall under Captain Nicholl’s bullets, for I have so tempting a proposition to make to the two rivals that they will hasten to accept it.”

“But what is it, pray?” asked Nicholl, with visible incredulity.

“Patience,” answered Ardan; “I can only communicate it in Barbicane’s presence.”

“Let us look for him, then,” cried the captain.

The three men immediately set out; the captain, having discharged his rifle, threw it on his shoulder and walked on in silence.

During another half-hour the search was in vain. Maston was seized with a sinister presentiment. He observed Captain Nicholl closely, asking himself if, once the captain’s vengeance satisfied, the unfortunate Barbicane had not been left lying in some bloody thicket. Michel Ardan seemed to have the same thought, and they were both looking questioningly at Captain Nicholl when Maston suddenly stopped.

The motionless bust of a man leaning against a gigantic catalpa appeared twenty feet off half hidden in the grass.

“It is he!” said Maston.

Barbicane did not move. Ardan stared at the captain, but he did not wince. Ardan rushed forward, crying—

“Barbicane! Barbicane!”

No answer. Ardan was about to seize his arm; he stopped short, uttering a cry of surprise.

Barbicane, with a pencil in his hand, was tracing geometrical figures upon a memorandum-book, whilst his unloaded gun lay on the ground.

Absorbed in his work, the *savant*, forgetting in his turn his duel and his vengeance, had neither seen nor heard anything.

But when Michel Ardan placed his hand on that of the president, he got up and looked at him with astonishment.

“Ah!” cried he at last; “you here! I have found it, my friend, I have found it!”

“What?”

“The way to do it.”

“The way to do what?”

“To counteract the effect of the shock at the departure of the projectile.”

“Really?” said Michel, looking at the captain out of the corner of his eye.

“Yes, water! simply water, which will act as a spring. Ah, Maston!” cried Barbicane, “you too!”

“Himself,” answered Michel Ardan; “and allow me to introduce at the same time the worthy Captain Nicholl.”

“Nicholl!” cried Barbicane, up in a moment. “Excuse me, captain,” said he; “I had forgotten. I am ready.”

Michel Ardan interfered before the two enemies had time to recriminate.

“Faith,” said he, “it is fortunate that brave fellows like you did not meet sooner. We should now have to mourn for one or other of you; but, thanks to God, who has prevented it, there is nothing more to fear. When one forgets his hatred to plunge into mechanical problems and the other to play tricks on spiders, their hatred cannot be dangerous to anybody.”

And Michel Ardan related the captain’s story to the president.

“I ask you now,” said he as he concluded, “if two good beings like you were made to break each other’s heads with gunshots?”

There was in this rather ridiculous situation something so unexpected, that Barbicane and Nicholl did not know how to look at one another. Michel Ardan felt this, and resolved to try for a reconciliation.

“My brave friends,” said he, smiling in his most fascinating manner, “it has all been a mistake between you, nothing more. Well, to prove that all is ended between you, and as you are men who risk your lives, frankly accept the proposition that I am going to make to you.”

“Speak,” said Nicholl.

“Friend Barbicane believes that his projectile will go straight to the moon.”

“Yes, certainly,” replied the president.

“And friend Nicholl is persuaded that it will fall back on the earth.”

“I am certain of it,” cried the captain.

“Good,” resumed Michel Ardan. “I do not pretend to make you agree; all I say to you is, ‘Come with me, and see if we shall stop on the road.’”

“What?” said J.T. Maston, stupefied.

The two rivals at this sudden proposition had raised their eyes and looked at each other attentively. Barbicane waited for Captain Nicholl’s answer; Nicholl awaited the president’s reply.

“Well,” said Michel in his most engaging tone, “as there is now no shock to fear——”

“Accepted!” cried Barbicane.

But although this word was uttered very quickly, Nicholl had finished it at the same time.

“Hurrah! bravo!” cried Michel Ardan, holding out his hands to the two adversaries. “And now that the affair is arranged, my friends, allow me to treat you French fashion. *Allons déjeuner*.”

XXII. The New Citizen Of The United States

That day all America heard about the duel and its singular termination. The part played by the chivalrous European, his unexpected proposition which solved the difficulty, the simultaneous acceptation of the two rivals, that conquest of the lunar continent to which France and the United States were going to march in concert—everything tended to increase Michel Ardan's popularity. It is well known how enthusiastic the Yankees will get about an individual. In a country where grave magistrates harness themselves to a dancer's carriage and draw it in triumph, it may be judged how the bold Frenchman was treated. If they did not take out his horses it was probably because he had none, but all other marks of enthusiasm were showered upon him. There was no citizen who did not join him heart and mind:—*Ex pluribus unam*, according to the motto of the United States.

From that day Michel Ardan had not a minute's rest. Deputations from all parts of the Union worried him incessantly. He was forced to receive them whether he would or no. The hands he shook could not be counted; he was soon completely worn out, his voice became hoarse in consequence of his innumerable speeches, and only escaped from his lips in unintelligible sounds, and he nearly caught a gastro-enterite after the toasts he proposed to the Union. This success would have intoxicated another man from the first, but he managed to stay in a *spirituelle* and charming demi-inebriety.

Amongst the deputations of every sort that assailed him, that of the "Lunatics" did not forget what they owed to the future conqueror of the moon. One day some of these poor creatures, numerous enough in America, went to him and asked to return with him to their native country. Some of them pretended to speak "Selenite," and wished to teach it to Michel Ardan, who willingly lent himself to their innocent mania, and promised to take their messages to their friends in the moon.

"Singular folly!" said he to Barbicane, after having dismissed them; "and a folly that often takes possession of men of great intelligence. One of our most illustrious *savants*, Arago, told me that many very wise and reserved people in their conceptions became much excited and gave way to incredible singularities every time the moon occupied them. Do you believe in the influence of the moon upon maladies?"

"Very little," answered the president of the Gun Club.

"I do not either, and yet history has preserved some facts that, to say the least, are astonishing. Thus in 1693, during an epidemic, people perished in the greatest numbers on the 21st of January, during an eclipse. The celebrated Bacon fainted during the moon eclipses, and only came to himself after its entire emersion. King Charles VI. relapsed six times into madness during the year 1399, either at the new or full moon. Physicians have ranked epilepsy amongst the maladies that follow the phases of the moon. Nervous maladies have often appeared to be influenced by it. Mead speaks of a child who had convulsions when the moon was in opposition. Gall remarked that insane persons underwent an accession of their disorder twice in every month, at the epochs of the new and full moon. Lastly, a thousand observations of this sort made upon malignant fevers and somnambulism tend to prove that the Queen of Night has a mysterious influence upon terrestrial maladies."

"But how? why?" asked Barbicane.

"Why?" answered Ardan. "Why, the only thing I can tell you is what Arago repeated nineteen centuries after Plutarch. Perhaps it is because it is not true."

In the height of his triumph Michel Ardan could not escape any of the annoyances incidental to a celebrated man. Managers of entertainments wished to exhibit him. Barnum offered him a million dollars to show him as a curious animal in the different towns of the United States.

Still, though he refused to satisfy public curiosity in that way, his portraits went all over the world, and occupied the place of honour in albums; proofs were made of all sizes from life size to medallions. Every one could possess the hero in all positions—head, bust, standing, full-face, profile, three-quarters, back. Fifteen hundred thousand copies were taken, and it would have been a fine occasion to get money by relics, but he did not profit by it. If he had sold his hairs for a dollar apiece there would have remained enough to make his fortune!

To tell the truth, this popularity did not displease him. On the contrary, he put himself at the disposition of the public, and corresponded with the entire universe. They repeated his witticisms, especially those he did not perpetrate.

Not only had he all the men for him, but the women too. What an infinite number of good marriages he might have made if he had taken a fancy to "settle!" Old maids especially dreamt before his portraits day and night.

It is certain that he would have found female companions by hundreds, even if he had imposed the condition of following him up into the air. Women are intrepid when they are not afraid of everything. But he had no intention of transplanting a race of Franco-Americans upon the lunar continent, so he refused.

"I do not mean," said he, "to play the part of Adam with a daughter of Eve up there. I might meet with serpents!"

As soon as he could withdraw from the joys of triumph, too often repeated, he went with his friends to pay a visit to the Columbiad. He owed it that. Besides, he was getting very learned in ballistics since he had lived with Barbicane, J.T. Maston, and *tutti quanti*. His greatest pleasure consisted in repeating to these brave artillerymen that they were only amiable and learned murderers. He was always joking about it. The day he visited the Columbiad he greatly admired it, and went down to the bore of the gigantic mortar that was soon to hurl him towards the Queen of Night.

"At least," said he, "that cannon will not hurt anybody, which is already very astonishing on the part of a cannon. But as to your engines that destroy, burn, smash, and kill, don't talk to me about them!"

It is necessary to report here a proposition made by J.T. Maston. When the secretary of the Gun Club heard Barbicane and Nicholl accept Michel Ardan's proposition he resolved to join them, and make a party of four. One day he asked to go. Barbicane, grieved at having to refuse, made him understand that the projectile could not carry so many passengers. J.T. Maston, in despair, went to Michel Ardan, who advised him to be resigned, adding one or two arguments *ad hominem*.

"You see, old fellow," he said to him, "you must not be offended, but really, between ourselves, you are too incomplete to present yourself in the moon."

"Incomplete!" cried the valiant cripple.

"Yes, my brave friend. Suppose we should meet with inhabitants up there. Do you want to give them a sorry idea of what goes on here, teach them what war is, show them that we employ the best part of our time in devouring each other and breaking arms and limbs, and that upon a globe that could feed a hundred thousand millions of inhabitants, and where there

are hardly twelve hundred millions? Why, my worthy friend, you would have us shown to the door!"

"But if you arrive smashed to pieces," replied J.T. Maston, "you will be as incomplete as I."

"Certainly," answered Michel Ardan, "but we shall not arrive in pieces."

In fact, a preparatory experiment, tried on the 18th of October, had been attended with the best results, and given rise to the most legitimate hopes. Barbicane, wishing to know the effect of the shock at the moment of the projectile's departure, sent for a 32-inch mortar from Pensacola Arsenal. It was installed upon the quay of Hillisboro Harbour, in order that the bomb might fall into the sea, and the shock of its fall be deadened. He only wished to experiment upon the shock of its departure, not that of its arrival.

A hollow projectile was prepared with the greatest care for this curious experiment. A thick wadding put upon a network of springs made of the best steel lined it inside. It was quite a wadded nest.

"What a pity one can't go in it!" said J.T. Maston, regretting that his size did not allow him to make the venture.

Into this charming bomb, which was closed by means of a lid, screwed down, they put first a large cat, then a squirrel belonging to the perpetual secretary of the Gun Club, which J.T. Maston was very fond of. But they wished to know how this little animal, not likely to be giddy, would support this experimental journey.

The mortar was loaded with 160 lbs. of powder and the bomb. It was then fired.

The projectile immediately rose with rapidity, described a majestic parabola, attained a height of about a thousand feet, and then with a graceful curve fell into the waves.

Without losing an instant, a vessel was sent to the spot where it fell; skilful divers sank under water and fastened cable-chains to the handles of the bomb, which was rapidly hoisted on board. Five minutes had not elapsed between the time the animals were shut up and the unscrewing of their prison lid.

Ardan, Barbicane, Maston, and Nicholl were upon the vessel, and they assisted at the operation with a sentiment of interest easy to understand. The bomb was hardly opened before the cat sprang out, rather bruised but quite lively, and not looking as if it had just returned from an aërial expedition. But nothing, was seen of the squirrel. The truth was then discovered. The cat had eaten its travelling companion.

J.T. Maston was very grieved at the loss of his poor squirrel, and proposed to inscribe it in the martyrology of science.

However that may be, after this experiment all hesitation and fear were at an end; besides, Barbicane's plans were destined further to perfect the projectile, and destroy almost entirely the effect of the shock. There was nothing more to do but to start.

Two days later Michel Ardan received a message from the President of the Union, an honour which he much appreciated.

After the example of his chivalrous countryman, La Fayette, the government had bestowed upon him the title of "Citizen of the United States of America."

XXIII. The Projectile Compartment

After the celebrated Columbiad was completed public interest immediately centred upon the projectile, the new vehicle destined to transport the three bold adventurers across space. No one had forgotten that in his despatch of September 30th Michel Ardan asked for a modification of the plans laid out by the members of the committee.

President Barbicane then thought with reason that the form of the projectile was of slight importance, for, after crossing the atmosphere in a few seconds, it would meet with vacuum. The committee had therefore chosen the round form, so that the ball might turn over and over and do as it liked. But as soon as it had to be made into a vehicle, that was another thing. Michel Ardan did not want to travel squirrel-fashion; he wished to go up head up and feet down with as much dignity as in the car of a balloon, quicker of course, but without unseemly gambols.

New plans were, therefore, sent to the firm of Breadwill and Co., of Albany, with the recommendation to execute them without delay. The projectile, thus modified, was cast on the 2nd of November, and sent immediately to Stony Hill by the Eastern Railway.

On the 10th it arrived without accident at its place of destination. Michel Ardan, Barbicane, and Nicholl awaited with the most lively impatience this “projectile compartment” in which they were to take their passage for the discovery of a new world.

It must be acknowledged that it was a magnificent piece of metal, a metallurgic production that did the greatest honour to the industrial genius of the Americans. It was the first time that aluminium had been obtained in so large a mass, which result might be justly regarded as prodigious. This precious projectile sparkled in the rays of the sun. Seeing it in its imposing shape with its conical top, it might easily have been taken for one of those extinguisher-shaped towers that architects of the Middle Ages put at the angles of their castles. It only wanted loopholes and a weathercock.

“I expect,” exclaimed Michel Ardan, “to see a man armed *cap-à-pie* come out of it. We shall be like feudal lords in there; with a little artillery we could hold our own against a whole army of Selenites—that is, if there are any in the moon!”

“Then the vehicle pleases you?” asked Barbicane.

“Yes, yes! certainly,” answered Michel Ardan, who was examining it as an artist. “I only regret that its form is not a little more slender, its cone more graceful; it ought to be terminated by a metal group, some Gothic ornament, a salamander escaping from it with outspread wings and open beak.”

“What would be the use?” said Barbicane, whose positive mind was little sensitive to the beauties of art.

“Ah, friend Barbicane, I am afraid you will never understand the use, or you would not ask!”

“Well, tell me, at all events, my brave companion.”

“Well, my friend, I think we ought always to put a little art in all we do. Do you know an Indian play called *The Child’s Chariot*?”

“Not even by name,” answered Barbicane.

“I am not surprised at that,” continued Michel Ardan. “Learn, then, that in that play there is a robber who, when in the act of piercing the wall of a house, stops to consider whether he shall make his hole in the shape of a lyre, a flower, or a bird. Well, tell me, friend Barbicane, if at that epoch you had been his judge would you have condemned that robber?”

“Without hesitation,” answered the president of the Gun Club, “and as a burglar too.”

“Well, I should have acquitted him, friend Barbicane. That is why you could never understand me.”

“I will not even try, my valiant artist.”

“But, at least,” continued Michel Ardan, “as the exterior of our projectile compartment leaves much to be desired, I shall be allowed to furnish the inside as I choose, and with all luxury suitable to ambassadors from the earth.”

“About that, my brave Michel,” answered Barbicane, “you can do entirely as you please.”

But before passing to the agreeable the president of the Gun Club had thought of the useful, and the means he had invented for lessening the effects of the shock were applied with perfect intelligence.

Barbicane had said to himself, not unreasonably, that no spring would be sufficiently powerful to deaden the shock, and during his famous promenade in Skersnaw Wood he had ended by solving this great difficulty in an ingenious fashion. He depended upon water to render him this signal service. This is how:—

The projectile was to be filled to the depth of three feet with water destined to support a water-tight wooden disc, which easily worked within the walls of the projectile. It was upon this raft that the travellers were to take their place. As to the liquid mass, it was divided by horizontal partitions which the departing shock would successively break; then each sheet of water, from the lowest to the highest, escaping by valves in the upper part of the projectile, thus making a spring, and the disc, itself furnished with extremely powerful buffers, could not strike the bottom until it had successively broken the different partitions. The travellers would doubtless feel a violent recoil after the complete escape of the liquid mass, but the first shock would be almost entirely deadened by so powerful a spring.

It is true that three feet on a surface of 541 square feet would weigh nearly 11,500 lbs; but the escape of gas accumulated in the Columbiad would suffice, Barbicane thought to conquer that increase of weight; besides, the shock would send out all that water in less than a second, and the projectile would soon regain its normal weight.

This is what the president of the Gun Club had imagined, and how he thought he had solved the great question of the recoil. This work, intelligently comprehended by the engineers of the Breadwill firm, was marvellously executed; the effect once produced and the water gone, the travellers could easily get rid of the broken partitions and take away the mobile disc that bore them at the moment of departure.

As to the upper sides of the projectile, they were lined with a thick wadding of leather, put upon the best steel springs as supple as watch-springs. The escape-pipes hidden under this wadding were not even seen.

All imaginable precautions for deadening the first shock having been taken, Michel Ardan said they must be made of “very bad stuff” to be crushed.

The projectile outside was nine feet wide and twelve feet high. In order not to pass the weight assigned the sides had been made a little less thick and the bottom thicker, as it would have to

support all the violence of the gases developed by the deflagration of the pyroxyle. Bombs and cylindro-conical howitzers are always made with thicker bottoms.

The entrance to this tower of metal was a narrow opening in the wall of the cone, like the "man-hole" of steam boilers. It closed hermetically by means of an aluminium plate fastened inside by powerful screw pressure. The travellers could therefore leave their mobile prison at will as soon as they had reached the Queen of Night.

But going was not everything; it was necessary to see on the road. Nothing was easier. In fact, under the wadding were four thick lenticular footlights, two let into the circular wall of the projectile, the third in its lower part, and the fourth in its cone. The travellers could, therefore, observe during their journey the earth they were leaving, the moon they were approaching, and the constellated spaces of the sky. These skylights were protected against the shocks of departure by plates let into solid grooves, which it was easy to move by unscrewing them. By that means the air contained in the projectile could not escape, and it was possible to make observations.

All these mechanical appliances, admirably set, worked with the greatest ease, and the engineers had not shown themselves less intelligent in the arrangement of the projectile compartment.

Lockers solidly fastened were destined to contain the water and provisions necessary for the three travellers; they could even procure themselves fire and light by means of gas stored up in a special case under a pressure of several atmospheres. All they had to do was to turn a tap, and the gas would light and warm this comfortable vehicle for six days. It will be seen that none of the things essential to life, or even to comfort, were wanting. More, thanks to the instincts of Michel Ardan, the agreeable was joined to the useful under the form of objects of art; he would have made a veritable artist's studio of his projectile if room had not been wanting. It would be mistaken to suppose that three persons would be restricted for space in that metal tower. It had a surface of 54 square feet, and was nearly 10 feet high, and allowed its occupiers a certain liberty of movement. They would not have been so much at their ease in the most comfortable railway compartment of the United States.

The question of provisions and lighting having been solved, there remained the question of air. It was evident that the air confined in the projectile would not be sufficient for the travellers' respiration for four days; each man, in fact, consumes in one hour all the oxygen contained in 100 litres of air. Barbicane, his two companions, and two dogs that he meant to take, would consume every twenty-four hours 2,400 litres of oxygen, or a weight equal to 7 lbs. The air in the projectile must, therefore, be renewed. How? By a very simple method, that of Messrs. Reiset and Regnault, indicated by Michel Ardan during the discussion of the meeting.

It is known that the air is composed principally of twenty-one parts of oxygen and seventy-nine parts of azote. Now what happens in the act of respiration? A very simple phenomenon, Man absorbs the oxygen of the air, eminently adapted for sustaining life, and throws out the azote intact. The air breathed out has lost nearly five per cent, of its oxygen, and then contains a nearly equal volume of carbonic acid, the definitive product of the combustion of the elements of the blood by the oxygen breathed in it. It happens, therefore, that in a confined space and after a certain time all the oxygen of the air is replaced by carbonic acid, an essentially deleterious gas.

The question was then reduced to this, the azote being conserved intact—1. To remake the oxygen absorbed; 2. To destroy the carbonic acid breathed out. Nothing easier to do by means of chlorate of potash and caustic potash. The former is a salt which appears under the

form of white crystals; when heated to a temperature of 400° it is transformed into chlorine of potassium, and the oxygen which it contains is given off freely. Now 18 lbs. of chlorate of potash give 7 lbs of oxygen—that is to say, the quantity necessary to the travellers for twenty-four hours.

As to caustic potash, it has a great affinity for carbonic acid mixed in air, and it is sufficient to shake it in order for it to seize upon the acid and form bicarbonate of potash. So much for the absorption of carbonic acid.

By combining these two methods they were certain of giving back to vitiated air all its life-giving qualities. The two chemists, Messrs. Reiset and Regnault, had made the experiment with success.

But it must be said the experiment had only been made *in anima vili*. Whatever its scientific accuracy might be, no one knew how man could bear it.

Such was the observation made at the meeting where this grave question was discussed. Michel Ardan meant to leave no doubt about the possibility of living by means of this artificial air, and he offered to make the trial before the departure.

But the honour of putting it to the proof was energetically claimed by J.T. Maston.

“As I am not going with you,” said the brave artilleryman, “the least I can do will be to live in the projectile for a week.”

It would have been ungracious to refuse him. His wish was complied with. A sufficient quantity of chlorate of potash and caustic potash was placed at his disposition, with provisions for a week; then having shaken hands with his friends, on the 12th of November at 6 a.m., after having expressly recommended them not to open his prison before the 20th at 6 p.m., he crept into the projectile, the iron plate of which was hermetically shut.

What happened during that week? It was impossible to ascertain. The thickness of the projectile’s walls prevented any interior noise from reaching the outside.

On the 20th of November, at six o’clock precisely, the plate was removed; the friends of J.T. Maston were rather uneasy. But they were promptly reassured by hearing a joyful voice shouting a formidable hurrah!

The secretary of the Gun Club appeared on the summit of the cone in a triumphant attitude.

He had grown fat!

XXIV. The Telescope Of The Rocky Mountains

On the 20th of October of the preceding year, after the subscription list was closed, the president of the Gun Club had credited the Cambridge Observatory with the sums necessary for the construction of a vast optical instrument. This telescope was to be powerful enough to render visible on the surface of the moon an object being at least nine feet wide.

There is an important difference between a field-glass and a telescope, which it is well to recall here. A field-glass is composed of a tube which carries at its upper extremity a convex glass called an object-glass, and at its lower extremity a second glass called ocular, to which the eye of the observer is applied. The rays from the luminous object traverse the first glass, and by refraction form an image upside down at its focus. This image is looked at with the ocular, which magnifies it. The tube of the field-glass is, therefore, closed at each extremity by the object and the ocular glasses.

The telescope, on the contrary, is open at its upper extremity. The rays from the object observed penetrate freely into it, and strike a concave metallic mirror—that is to say, they are focussed. From thence their reflected rays meet with a little mirror, which sends them back to the ocular in such a way as to magnify the image produced.

Thus in field-glasses refraction plays the principal part, and reflection does in the telescope. Hence the name of refractors given to the former, and reflectors given to the latter. All the difficulty in the execution of these optical instruments lies in the making of the object-glass, whether they be made of glass or metallic mirrors.

Still at the epoch when the Gun Club made its great experiment these instruments were singularly perfected and gave magnificent results. The time was far distant when Galileo observed the stars with his poor glass, which magnified seven times at the most. Since the 16th century optical instruments had widened and lengthened in considerable proportions, and they allowed the stellar spaces to be gauged to a depth unknown before. Amongst the refracting instruments at work at that period were the glass of the Poulkowa Observatory in Russia, the object-glass of which measured 15 inches in width, that of the French optician Lerebours, furnished with an object-glass equally large, and lastly that of the Cambridge Observatory, furnished with an object-glass 19 inches in diameter.

Amongst telescopes, two were known of remarkable power and gigantic dimensions. The first, constructed by Herschel, was 36 feet in length, and had an object-glass of 4 feet 6 inches; it magnified 6,000 times; the second, raised in Ireland, at Birrcastle, in Parsonstown Park, belonged to Lord Rosse; the length of its tube was 48 feet and the width of its mirror 6 feet; it magnified 6,400 times, and it had required an immense erection of masonry on which to place the apparatus necessary for working the instrument, which weighed 12-1/2 tons.

But it will be seen that notwithstanding these colossal dimensions the magnifying power obtained did not exceed 6,000 times in round numbers; now that power would only bring the moon within 39 miles, and would only allow objects 60 feet in diameter to be perceived unless these objects were very elongated.

Now in space they had to deal with a projectile 9 feet wide and 15 long, so the moon had to be brought within five miles at least, and for that a magnifying power of 48,000 times was necessary.

Such was the problem propounded to the Cambridge Observatory. They were not to be stopped by financial difficulties, so there only remained material difficulties.

First of all they had to choose between telescopes and field-glasses. The latter had some advantages. With equal object-glasses they have a greater magnifying power, because the luminous rays that traverse the glasses lose less by absorption than the reflection on the metallic mirror of telescopes; but the thickness that can be given to glass is limited, for too thick it does not allow the luminous rays to pass. Besides, the construction of these vast glasses is excessively difficult, and demands a considerable time, measured by years.

Therefore, although images are better given by glasses, an inappreciable advantage when the question is to observe the moon, the light of which is simply reflected they decided to employ the telescope, which is prompter in execution and is capable of a greater magnifying power; only as the luminous rays lose much of their intensity by traversing the atmosphere, the Gun Club resolved to set up the instrument on one of the highest mountains of the Union, which would diminish the depth of the aërial strata.

In telescopes it has been seen that the glass placed at the observer's eye produces the magnifying power, and the object-glass which bears this power the best is the one that has the largest diameter and the greatest focal distance. In order to magnify 48,000 times it must be much larger than those of Herschel and Lord Rosse. There lay the difficulty, for the casting of these mirrors is a very delicate operation.

Happily, some years before a *savant* of the *Institut de France*, Léon Foucault, had just invented means by which the polishing of object-glasses became very prompt and easy by replacing the metallic mirror by taking a piece of glass the size required and plating it.

It was to be fixed according to the method invented by Herschel for telescopes. In the great instrument of the astronomer at Slough, the image of objects reflected by the mirror inclined at the bottom of the tube was formed at the other extremity where the eyeglass was placed. Thus the observer, instead of being placed at the lower end of the tube, was hoisted to the upper end, and there with his eyeglass he looked down into the enormous cylinder. This combination had the advantage of doing away with the little mirror destined to send back the image to the ocular glass, which thus only reflected once instead of twice; therefore there were fewer luminous rays extinguished, the image was less feeble, and more light was obtained, a precious advantage in the observation that was to be made.

This being resolved upon, the work was begun. According to the calculations of the Cambridge Observatory staff, the tube of the new reflector was to be 280 feet long and its mirror 16 feet in diameter. Although it was so colossal it was not comparable to the telescope 10,000 feet long which the astronomer Hooke proposed to construct some years ago. Nevertheless the setting up of such an apparatus presented great difficulties.

The question of its site was promptly settled. It must be upon a high mountain, and high mountains are not numerous in the States.

In fact, the orographical system of this great country only contains two chains of average height, amongst which flows the magnificent Mississippi, which the Americans would call the "king of rivers" if they admitted any royalty whatever.

On the east rise the Apalachians, the very highest point of which, in New Hampshire, does not exceed the very moderate altitude of 5,600 feet.

On the west are, however, the Rocky Mountains, that immense chain which begins at the Straits of Magellan, follows the west coast of South America under the name of the Andes or

Cordilleras, crosses the Isthmus of Panama, and runs up the whole of North America to the very shores of the Polar Sea.

These mountains are not very high, and the Alps or Himalayas would look down upon them with disdain. In fact, their highest summit is only 10,701 feet high, whilst Mont Blanc is 14,439, and the highest summit of the Himalayas is 26,776 feet above the level of the sea.

But as the Gun Club wished that its telescope, as well as the Columbiad, should be set up in the States of the Union, they were obliged to be content with the Rocky Mountains, and all the necessary material was sent to the summit of Long's Peak in the territory of Missouri.

Neither pen nor language could relate the difficulties of every kind that the American engineers had to overcome, and the prodigies of audacity and skill that they accomplished. Enormous stones, massive pieces of wrought-iron, heavy corner-clamps, and huge portions of cylinder had to be raised with an object-glass, weighing nearly 30,000 lbs., above the line of perpetual snow for more than 10,000 feet in height, after crossing desert prairies, impenetrable forests, fearful rapids far from all centres of population, and in the midst of savage regions in which every detail of life becomes an insoluble problem, and, nevertheless, American genius triumphed over all these obstacles. Less than a year after beginning the works in the last days of the month of September, the gigantic reflector rose in the air to a height of 280 feet. It was hung from an enormous iron scaffolding; an ingenious arrangement allowed it to be easily moved towards every point of the sky, and to follow the stars from one horizon to the other during their journey across space.

It had cost more than 400,000 dollars. The first time it was pointed at the moon the observers felt both curious and uneasy. What would they discover in the field of this telescope which magnified objects 48,000 times? Populations, flocks of lunar animals, towns, lakes, and oceans? No, nothing that science was not already acquainted with, and upon all points of her disc the volcanic nature of the moon could be determined with absolute precision.

But the telescope of the Rocky Mountains, before being used by the Gun Club, rendered immense services to astronomy. Thanks to its power of penetration, the depths of the sky were explored to their utmost limits, the apparent diameter of a great number of stars could be rigorously measured, and Mr. Clarke, of the Cambridge staff, resolved the Crab nebula in Taurus, which Lord Rosse's reflector had never been able to do.

XXV. Final Details

It was the 22nd of November. The supreme departure was to take place ten days later. One operation still remained to bring it to a happy termination, a delicate and perilous operation exacting infinite precautions, and against the success of which Captain Nicholl had laid his third bet. It was, in fact, nothing less than the loading of the gun and the introduction into it of 400,000 lbs. of gun-cotton. Nicholl had thought, not without reason, perhaps, that the handling of so large a quantity of pyroxyle would cause grave catastrophes, and that in any case this eminently explosive mass would ignite of itself under the pressure of the projectile.

There were also grave dangers increased by the carelessness of the Americans, who, during the Federal war, used to load their cannon cigar in mouth. But Barbicane had set his heart on succeeding, and did not mean to founder in port; he therefore chose his best workmen, made them work under his superintendence, and by dint of prudence and precautions he managed to put all the chances of success on his side.

First he took care not to bring all his charge at once to the inclosure of Stony Hill. He had it brought little by little carefully packed in sealed cases. The 400,000 lbs. of pyroxyle had been divided into packets of 500 lbs., which made 800 large cartridges made carefully by the cleverest artisans of Pensacola. Each case contained ten, and they arrived one after the other by the railroad of Tampa Town; by that means there were never more than 500 lbs. of pyroxyle at once in the inclosure. As soon as it arrived each case was unloaded by workmen walking barefoot, and each cartridge transported to the orifice of the Columbiad, into which they lowered them by means of cranes worked by the men. Every steam-engine had been excluded, and the least fires extinguished for two miles round. Even in November it was necessary to preserve this gun-cotton from the ardour of the sun. So they worked at night by light produced in a vacuum by means of Rühmkorff's apparatus, which threw an artificial brightness into the depths of the Columbiad. There the cartridges were arranged with the utmost regularity, fastened together by a wire destined to communicate the electric spark to them all simultaneously.

In fact, it was by means of electricity that fire was to be set to this mass of gun-cotton. All these single wires, surrounded by isolating material, were rolled into a single one at a narrow hole pierced at the height the projectile was to be placed; there they crossed the thick metal wall and came up to the surface by one of the vent-holes in the masonry made on purpose. Once arrived at the summit of Stony Hill, the wire supported on poles for a distance of two miles met a powerful pile of Bunsen passing through a non-conducting apparatus. It would, therefore, be enough to press with the finger the knob of the apparatus for the electric current to be at once established, and to set fire to the 400,000 lbs. of gun-cotton. It is hardly necessary to say that this was only to be done at the last moment.

On the 28th of November the 800 cartridges were placed at the bottom of the Columbiad. That part of the operation had succeeded. But what worry, anxiety, and struggles President Barbicane had to undergo! In vain had he forbidden entrance to Stony Hill; every day curious sightseers climbed over the palisading, and some, pushing imprudence to folly, came and smoked amongst the bales of gun-cotton. Barbicane put himself into daily rages. J.T. Maston seconded him to the best of his ability, chasing the intruders away and picking up the still-lighted cigar-ends which the Yankees threw about—a rude task, for more than 300,000 people pressed round the palisades. Michel Ardan had offered himself to escort the cases to the mouth of the gun, but having caught him with a cigar in his mouth whilst he drove out the

intruders to whom he was giving this unfortunate example, the president of the Gun Club saw that he could not depend upon this intrepid smoker, and was obliged to have him specially watched.

At last, there being a Providence even for artillerymen, nothing blew up, and the loading was happily terminated. The third bet of Captain Nicholl was therefore much imperilled. There still remained the work of introducing the projectile into the Columbiad and placing it on the thick bed of gun-cotton.

But before beginning this operation the objects necessary for the journey were placed with order in the waggon-compartment. There were a good many of them, and if they had allowed Michel Ardan to do as he pleased he would soon have filled up all the space reserved for the travellers. No one can imagine all that the amiable Frenchman wished to carry to the moon—a heap of useless trifles. But Barbicane interfered, and refused all but the strictly necessary.

Several thermometers, barometers, and telescopes were placed in the instrument-case.

The travellers were desirous of examining the moon during their transit, and in order to facilitate the survey of this new world they took an excellent map by Boeer and Moedler, the *Mappa Selenographica*, published in four plates, which is justly looked upon as a masterpiece of patience and observation. It represented with scrupulous exactitude the slightest details of that portion of the moon turned towards the earth. Mountains, valleys, craters, peaks, watersheds, were depicted on it in their exact dimensions, faithful positions, and names, from Mounts Doerfel and Leibnitz, whose highest summits rise on the eastern side of the disc, to the *Mare Frigoris*, which extends into the North Polar regions.

It was, therefore, a precious document for the travellers, for they could study the country before setting foot upon it.

They took also three rifles and three fowling-pieces with powder and shot in great quantity.

“We do not know with whom we may have to deal,” said Michel Ardan. “Both men and beasts may be displeased at our visit; we must, therefore, take our precautions.”

The instruments of personal defence were accompanied by pickaxes, spades, saws, and other indispensable tools, without mentioning garments suitable to every temperature, from the cold of the polar regions to the heat of the torrid zone.

Michel Ardan would have liked to take a certain number of animals of different sorts, not male and female of every species, as he did not see the necessity of acclimatising serpents, tigers, alligators, or any other noxious beasts in the moon.

“No,” said he to Barbicane, “but some useful animals, ox or cow, ass or horse, would look well in the landscape and be of great use.”

“I agree with you, my dear Ardan,” answered the president of the Gun Club; “but our projectile is not Noah’s Ark. It differs both in dimensions and object, so let us remain in the bounds of possibility.”

At last after long discussions it was agreed that the travellers should be content to take with them an excellent sporting dog belonging to Nicholl and a vigorous Newfoundland of prodigious strength. Several cases of the most useful seeds were included amongst the indispensable objects. If they had allowed him, Michel Ardan would have taken several sacks of earth to sow them in. Any way he took a dozen little trees, which were carefully enveloped in straw and placed in a corner of the projectile.

Then remained the important question of provisions, for they were obliged to provide against finding the moon absolutely barren. Barbicane managed so well that he took enough for a year. But it must be added, to prevent astonishment, that these provisions consisted of meat and vegetable compressed to their smallest volume by hydraulic pressure, and included a great quantity of nutritive elements; there was not much variety, but it would not do to be too particular in such an expedition. There was also about fifty gallons of brandy and water for two months only, for, according to the latest observations of astronomers, no one doubted the presence of a large quantity of water in the moon. As to provisions, it would have been insane to believe that the inhabitants of the earth would not find food up there. Michel Ardan had no doubt about it. If he had he would not have gone.

“Besides,” said he one day to his friends, “we shall not be completely abandoned by our friends on earth, and they will take care not to forget us.”

“No, certainly,” answered J.T. Maston.

“What do you mean?” asked Nicholl.

“Nothing more simple,” answered Ardan. “Will not our Columbiad be still there? Well, then, every time that the moon is in favourable conditions of zenith, if not of perigee—that is to say, about once a year—could they not send us a projectile loaded with provisions which we should expect by a fixed date?”

“Hurrah!” cried J.T. Maston. “That is not at all a bad idea. Certainly we will not forget you.”

“I depend upon you. Thus you see we shall have news regularly from the globe, and for our part we shall be very awkward if we do not find means to communicate with our good friends on earth.”

These words inspired such confidence that Michel Ardan with his superb assurance would have carried the whole Gun Club with him. What he said seemed simple, elementary, and sure of success, and it would have been sordid attachment to this earth to hesitate to follow the three travellers upon their lunar expedition.

When the different objects were placed in the projectile the water was introduced between the partitions and the gas for lighting purposes laid in. Barbicane took enough chlorate of potash and caustic potash for two months, as he feared unforeseen delay. An extremely ingenious machine working automatically put the elements for good air in motion. The projectile, therefore, was ready, and the only thing left to do was to lower it into the gun, an operation full of perils and difficulty.

The enormous projectile was taken to the summit of Stony Hill. There enormous cranes seized it and held it suspended over the metal well.

This was an anxious moment. If the chains were to break under the enormous weight the fall of such a mass would inevitably ignite the gun-cotton.

Happily nothing of the sort happened, and a few hours afterwards the projectile-compartment rested on its pyroxyle bed, a veritable fulminating pillow. The only effect of its pressure was to ram the charge of the gun more strongly.

“I have lost,” said the captain, handing the sum of 3,000 dollars to President Barbicane.

Barbicane did not wish to receive this money from his travelling companion, but he was obliged to give way to Nicholl, who wished to fulfil all his engagements before leaving the earth.

“Then,” said Michel Ardan, “there is but one thing I wish for you now, captain.”

“What is that?” asked Nicholl.

“It is that you may lose your other two wagers. By that means we shall be sure not to be stopped on the road.”

XXVI. Fire!

The 1st of December came, the fatal day, for if the projectile did not start that very evening at 10h. 46m. and 40s. p.m., more than eighteen years would elapse before the moon would present the same simultaneous conditions of zenith and perigee.

The weather was magnificent; notwithstanding the approach of winter the sun shone brightly and bathed in its radiance that earth which three of its inhabitants were about to leave for a new world.

How many people slept badly during the night that preceded the ardently-longed-for day! How many breasts were oppressed with the heavy burden of waiting! All hearts beat with anxiety except only the heart of Michel Ardan. This impassible person went and came in his usual business-like way, but nothing in him denoted any unusual preoccupation. His sleep had been peaceful—it was the sleep of Turenne upon a gun-carriage the night before the battle.

From early dawn an innumerable crowd covered the prairie, which extended as far as the eye could reach round Stony Hill. Every quarter of an hour the railroad of Tampa brought fresh sightseers. According to the *Tampa Town Observer*, five millions of spectators were that day upon Floridian soil.

The greater part of this crowd had been living in tents round the inclosure, and laid the foundations of a town which has since been called “Ardan’s Town.” The ground bristled with huts, cabins, and tents, and these ephemeral habitations sheltered a population numerous enough to rival the largest cities of Europe.

Every nation upon earth was represented; every language was spoken at the same time. It was like the confusion of tongues at the Tower of Babel. There the different classes of American society mixed in absolute equality. Bankers, cultivators, sailors, agents, merchants, cotton-planters, and magistrates elbowed each other with primitive ease. The creoles of Louisiana fraternised with the farmers of Indiana; the gentlemen of Kentucky and Tennessee, the elegant and haughty Virginians, joked with the half-savage trappers of the Lakes and the butchers of Cincinnati. They appeared in broad-brimmed white beavers and Panamas, blue cotton trousers, from the Opelousa manufactories, draped in elegant blouses of écru cloth, in boots of brilliant colours, and extravagant shirt-frills; upon shirt-fronts, cuffs, cravats, on their ten fingers, even in their ears, an assortment of rings, pins, diamonds, chains, buckles, and trinkets, the cost of which equalled the bad taste. Wife, children, servants, in no less rich dress, accompanied, followed, preceded, and surrounded their husbands, fathers, and masters, who resembled the patriarchs amidst their innumerable families.

At meal-times it was a sight to see all these people devour the dishes peculiar to the Southern States, and eat, with an appetite menacing to the provisioning of Florida, the food that would be repugnant to a European stomach, such as fricasseed frogs, monkey-flesh, fish-chowder, underdone opossum, and raccoon steaks.

The liquors that accompanied this indigestible food were numerous. Shouts and vociferations to buy resounded through the bar-rooms or taverns, decorated with glasses, tankards, decanters, and bottles of marvellous shapes, mortars for pounding sugar, and bundles of straws.

“Mint-julep!” roars out one of the salesmen.

“Claret sangaree!” shouts another through his nose.

“Gin-sling!” shouts one.

“Cocktail! Brandy-smash!” cries another.

“Who’ll buy real mint-julep in the latest style?” shouted these skilful salesmen, rapidly passing from one glass to another the sugar, lemon, green mint, crushed ice, water, cognac, and fresh pine-apple which compose this refreshing drink.

Generally these sounds, addressed to throats made thirsty by the spices they consumed, mingled into one deafening roar. But on this 1st of December these cries were rare. No one thought of eating and drinking, and at 4 p.m. there were many spectators in the crowd who had not taken their customary lunch! A much more significant fact, even the national passion for gaming was allayed by the general emotion. Thimbles, skittles, and cards were left in their wrappings, and testified that the great event of the day absorbed all attention.

Until nightfall a dull, noiseless agitation like that which precedes great catastrophes ran through the anxious crowd. An indescribable uneasiness oppressed all minds, and stopped the beating of all hearts. Every one wished it over.

However, about seven o’clock this heavy silence was suddenly broken. The moon rose above the horizon. Several millions of hurrahs saluted her apparition. She was punctual to the appointment. Shouts of welcome broke from all parts, whilst the blonde Phoebe shone peacefully in a clear sky, and caressed the enraptured crowd with her most affectionate rays.

At that moment the three intrepid travellers appeared. When they appeared the cries redoubled in intensity. Unanimously, instantaneously, the national song of the United States escaped from all the spectators, and “Yankee Doodle,” sung by 5,000,000 of hearty throats, rose like a roaring tempest to the farthest limits of the atmosphere.

Then, after this irresistible outburst, the hymn was ended, the last harmonies died away by degrees, and a silent murmur floated over the profoundly-excited crowd.

In the meantime the Frenchman and the two Americans had stepped into the inclosure round which the crowd was pressing. They were accompanied by the members of the Gun Club, and deputations sent by the European observatories. Barbicane was coolly and calmly giving his last orders. Nicholl, with compressed lips and hands crossed behind his back, walked with a firm and measured step. Michel Ardan, always at his ease, clothed in a perfect travelling suit, with leather gaiters on his legs, pouch at his side, in vast garment of maroon velvet, a cigar in his mouth, distributed shakes of the hand with princely prodigality. He was full of inexhaustible gaiety, laughing, joking, playing pranks upon the worthy J.T. Maston, and was, in a word, “French,” and, what is worse, “Parisian,” till the last second.

Ten o’clock struck. The moment had come to take their places in the projectile; the necessary mechanism for the descent the door-plate to screw down, the removal of the cranes and scaffolding hung over the mouth of the Columbiad, took some time.

Barbicane had set his chronometer to the tenth of a second by that of the engineer Murchison, who was entrusted with setting fire to the powder by means of the electric spark; the travellers shut up in the projectile could thus watch the impassive needle which was going to mark the precise instant of their departure.

The moment for saying farewell had come. The scene was touching; in spite of his gaiety Michel Ardan felt touched. J.T. Maston had found under his dry eyelids an ancient tear that he had, doubtless, kept for the occasion. He shed it upon the forehead of his dear president.

“Suppose I go too?” said he. “There is still time!”

“Impossible, old fellow,” answered Barbicane.

A few moments later the three travelling companions were installed in the projectile, and had screwed down the door-plate, and the mouth of the Columbiad, entirely liberated, rose freely towards the sky.

Nicholl, Barbicane, and Michel Ardan were definitively walled up in their metal vehicle.

Who could predict the universal emotion then at its paroxysm?

The moon was rising in a firmament of limpid purity, outshining on her passage the twinkling fire of the stars; she passed over the constellation of the Twins, and was now nearly halfway between the horizon and the zenith.

A frightful silence hung over all that scene. There was not a breath of wind on the earth! Not a sound of breathing from the crowd! Hearts dared not beat. Every eye was fixed on the gaping mouth of the Columbiad.

Murchison watched the needle of his chronometer. Hardly forty seconds had to elapse before the moment of departure struck, and each one lasted a century!

At the twentieth there was a universal shudder, and the thought occurred to all the crowd that the audacious travellers shut up in the vehicle were likewise counting these terrible seconds! Some isolated cries were heard.

“Thirty-five!—thirty-six!—thirty-seven!—thirty—eight!—thirty-nine! —forty! Fire!!!”

Murchison immediately pressed his finger upon the electric knob and hurled the electric spark into the depths of the Columbiad.

A fearful, unheard-of, superhuman report, of which nothing could give an idea, not even thunder or the eruption of volcanoes, was immediately produced. An immense spout of fire sprang up from the bowels of the earth as if from a crater. The soil heaved and very few persons caught a glimpse of the projectile victoriously cleaving the air amidst the flaming smoke.

XXVII. Cloudy Weather

At the moment when the pyramid of flame rose to a prodigious height in the air it lighted up the whole of Florida, and for an incalculable moment day was substituted for night over a considerable extent of country. This immense column of fire was perceived for a hundred miles out at sea, from the Gulf and from the Atlantic, and more than one ship's captain noted the apparition of this gigantic meteor in his log-book.

The discharge of the Columbiad was accompanied by a veritable earthquake. Florida was shaken to its very depths. The gases of the powder, expanded by heat, forced back the atmospheric strata with tremendous violence, passing like a waterspout through the air.

Not one spectator remained on his legs; men, women, and children were thrown down like ears of wheat in a storm; there was a terrible tumult, and a large number of people were seriously injured. J.T. Maston, who had very imprudently kept to the fore, was thrown twenty yards backwards like a bullet over the heads of his fellow-citizens. Three hundred thousand people were temporarily deafened and as though thunderstruck.

The atmospheric current, after throwing over huts and cabins, uprooting trees within a radius of twenty miles, throwing the trains off the railway as far as Tampa, burst upon the town like an avalanche and destroyed a hundred houses, amongst others the church of St. Mary and the new edifice of the Exchange. Some of the vessels in the port were run against each other and sunk, and ten of them were stranded high and dry after breaking their chains like threads of cotton.

But the circle of these devastations extended farther still, and beyond the limits of the United States. The recoil, aided by the westerly winds, was felt on the Atlantic at more than 300 miles from the American shores. An unexpected tempest, which even Admiral Fitzroy could not have foreseen, broke upon the ships with unheard-of violence. Several vessels, seized by a sort of whirlwind before they had time to furl their sails, were sunk, amongst others the *Childe Harold*, of Liverpool, a regrettable catastrophe which was the object of lively recriminations.

Lastly—although the fact is not warranted except by the affirmation of a few natives—half-an-hour after the departure of the projectile the inhabitants of Sierra-Leone pretended that they heard a dull noise, the last displacement of the sonorous waves, which, after crossing the Atlantic, died away on the African coast.

But to return to Florida. The tumult once lessened, the wounded and deaf—in short, all the crowd—rose and shouted in a sort of frenzy, "Hurrah for Ardan! Hurrah for Barbicane! Hurrah for Nicholl!" Several millions of men, nose in air, armed with telescopes and every species of field-glass, looked into space, forgetting contusions and feelings, in order to look at the projectile. But they sought in vain; it was not to be seen, and they resolved to await the telegrams from Long's Peak. The director of the Cambridge Observatory, M. Belfast, was at his post in the Rocky Mountains, and it was to this skilful and persevering astronomer that the observations had been entrusted.

But an unforeseen phenomenon, against which nothing could be done, soon came to put public impatience to a rude test.

The weather, so fine before, suddenly changed; the sky became covered with clouds. It could not be otherwise after so great a displacement of the atmospheric strata and the dispersion of

the enormous quantity of gases from the combustion of 200,000 lbs. of pyroxyle. All natural order had been disturbed. There is nothing astonishing in that, for in sea-fights it has been noticed that the state of the atmosphere has been suddenly changed by the artillery discharge.

The next day the sun rose upon an horizon covered with thick clouds, a heavy and an impenetrable curtain hung between earth and sky, and which unfortunately extended as far as the regions of the Rocky Mountains. It was a fatality. A concert of complaints rose from all parts of the globe. But Nature took no notice, and as men had chosen to disturb the atmosphere with their gun, they must submit to the consequences.

During this first day every one tried to pierce the thick veil of clouds, but no one was rewarded for the trouble; besides, they were all mistaken in supposing they could see it by looking up at the sky, for on account of the diurnal movement of the globe the projectile was then, of course, shooting past the line of the antipodes.

However that might be, when night again enveloped the earth—a dark, impenetrable night—it was impossible to see the moon above the horizon; it might have been thought that she was hiding on purpose from the bold beings who had shot at her. No observation was, therefore, possible, and the despatches from Long's Peak confirmed the disastrous intelligence.

However, if the experiment had succeeded, the travellers, who had started on the 1st of December, at 10h. 46m. 40s. p.m., were due at their destination on the 4th at midnight; so that as up to that time it would, after all, have been difficult to observe a body so small, people waited with all the patience they could muster.

On the 4th of December, from 8 p.m. till midnight, it would have been possible to follow the trace of the projectile, which would have appeared like a black speck on the shining disc of the moon. But the weather remained imperturbably cloudy, and exasperated the public, who swore at the moon for not showing herself. *Sic transit gloria mundi*!

J.T. Maston, in despair, set out for Long's Peak. He wished to make an observation himself. He did not doubt that his friends had arrived at the goal of their journey. No one had heard that the projectile had fallen upon any continent or island upon earth, and J.T. Maston did not admit for a moment that it could have fallen into any of the oceans with which the earth is three parts covered.

On the 5th the same weather. The large telescopes of the old world—those of Herschel, Rosse, and Foucault—were invariably fixed upon the Queen of Night, for the weather was magnificent in Europe, but the relative weakness of these instruments prevented any useful observation.

On the 6th the same weather reigned. Impatience devoured three parts of the globe. The most insane means were proposed for dissipating the clouds accumulated in the air.

On the 7th the sky seemed to clear a little. Hopes revived but did not last long, and in the evening thick clouds defended the starry vault against all eyes.

Things now became grave. In fact, on the 11th, at 9.11 a.m., the moon would enter her last quarter. After this delay she would decline every day, and even if the sky should clear the chances of observation would be considerably lessened—in fact, the moon would then show only a constantly-decreasing portion of her disc, and would end by becoming new—that is to say, she would rise and set with the sun, whose rays would make her quite invisible. They would, therefore, be obliged to wait till the 3rd of January, at 12.43 p.m., till she would be full again and ready for observation.

The newspapers published these reflections with a thousand commentaries, and did not fail to tell the public that it must arm itself with angelic patience.

On the 8th no change. On the 9th the sun appeared for a moment, as if to jeer at the Americans. It was received with hisses, and wounded, doubtless, by such a reception, it was very miserly of its rays.

On the 10th no change. J.T. Maston nearly went mad, and fears were entertained for his brain until then so well preserved in its gutta-percha cranium.

But on the 11th one of those frightful tempests peculiar to tropical regions was let loose in the atmosphere. Terrific east winds swept away the clouds which had been so long there, and in the evening the half-disc of the moon rode majestically amidst the limpid constellations of the sky.

XXVIII. A New Star

That same night the news so impatiently expected burst like a thunderbolt over the United States of the Union, and thence darting across the Atlantic it ran along all the telegraphic wires of the globe. The projectile had been perceived, thanks to the gigantic reflector of Long's Peak.

The following is the notice drawn up by the director of the Cambridge Observatory. It resumes the scientific conclusion of the great experiment made by the Gun Club:—

"Long's Peak, December 12th.

"To the Staff of the Cambridge Observatory.

"The projectile hurled by the Columbiad of Stony Hill was perceived by Messrs. Belfast and J.T. Maston on the 12th of December at 8.47 p.m., the moon having entered her last quarter.

"The projectile has not reached its goal. It has deviated to the side, but near enough to be detained by lunar attraction.

"There its rectilinear movement changed to a circular one of extreme velocity, and it has been drawn round the moon in an elliptical orbit, and has become her satellite.

"We have not yet been able to determine the elements of this new star. Neither its speed of translation or rotation is known. The distance which separates it from the surface of the moon may be estimated at about 2,833 miles.

"Now two hypotheses may be taken into consideration as to a modification in this state of things:—

"Either the attraction of the moon will end by drawing it towards her, and the travellers will reach the goal of their journey,

"Or the projectile, maintained in an immutable orbit, will gravitate round the lunar disc till the end of time.

"Observation will settle this point some day, but until now the experiment of the Gun Club has had no other result than that of providing our solar system with a new star.

"J BELFAST."

What discussions this unexpected *dénouement* gave rise to! What a situation full of mystery the future reserved for the investigations of science! Thanks to the courage and devotion of three men, this enterprise of sending a bullet to the moon, futile enough in appearance, had just had an immense result, the consequences of which are incalculable. The travellers imprisoned in a new satellite, if they have not attained their end, form at least part of the lunar world; they gravitate around the Queen of Night, and for the first time human eyes can penetrate all her mysteries. The names of Nicholl, Barbicane, and Michel Ardan would be for ever celebrated in astronomical annals, for these bold explorers, desirous of widening the circle of human knowledge, had audaciously rushed into space, and had risked their lives in the strangest experiment of modern times.

The notice from Long's Peak once made known, there spread throughout the universe a feeling of surprise and horror. Was it possible to go to the aid of these bold inhabitants of the earth? Certainly not, for they had put themselves outside of the pale of humanity by crossing the limits imposed by the Creator on His terrestrial creatures. They could procure themselves

air for two months; they had provisions for one year; but after? The hardest hearts palpitated at this terrible question.

One man alone would not admit that the situation was desperate. One alone had confidence, and it was their friend—devoted, audacious, and resolute as they—the brave J.T. Maston.

He resolved not to lose sight of them. His domicile was henceforth the post of Long's Peak—his horizon the immense reflector. As soon as the moon rose above the horizon he immediately framed her in the field of his telescope; he did not lose sight of her for an instant, and assiduously followed her across the stellar spaces; he watched with eternal patience the passage of the projectile over her disc of silver, and in reality the worthy man remained in perpetual communication with his three friends, whom he did not despair of seeing again one day.

"We will correspond with them," said he to any one who would listen, "as soon as circumstances will allow. We shall have news from them, and they will have news from us. Besides, I know them—they are ingenious men. Those three carry with them into space all the resources of art, science, and industry. With those everything can be accomplished, and you will see that they will get out of the difficulty."

THE END