The Moon Book

From the Earth To the Moon

and

Round the Moon

The Moon Book

From the Earth To the Moon

and

Round the Moon

JULES VERNE

PHOENIX PICK
an imprint of
ARC
MANOR
ROCKVILLE, MARYLAND
2008

The original text has been reformatted for clarity and to fit this edition.

ISBN: 978-1-60450-250-3

Published by Phoenix Pick
An Imprint of Arc Manor
P. O. Box 10339
Rockville, MD 20849-0339
www.ArcManor.com

Printed in the United States of America/United Kingdom

From the Earth to the Moon

Contents

∞∞∞∞∞∞∞∞∞∞∞∞∞

Round the Moon

Contents

∞∞∞∞∞∞∞∞∞∞∞∞∞

From the Earth To the Moon

I

The Gun Club

During the War of the Rebellion, a new and influential club was established in the city of Baltimore in the State of Maryland. It is well known with what energy the taste for military matters became developed among that nation of ship-owners, shopkeepers, and mechanics. Simple tradesmen jumped their counters to become extemporized captains, colonels, and generals, without having ever passed the School of Instruction at West Point; nevertheless; they quickly rivaled their compeers of the old continent, and, like them, carried off victories by dint of lavish expenditure in ammunition, money, and men.

But the point in which the Americans singularly distanced the Europeans was in the science of gunnery. Not, indeed, that their weapons retained a higher degree of perfection than theirs, but that they exhibited unheard-of dimensions, and consequently attained hitherto unheard-of ranges. In point of grazing, plunging, oblique, or enfilading, or point-blank firing, the English, French, and Prussians have nothing to learn; but their cannon, howitzers, and mortars are mere pocket-pistols compared with the formidable engines of the American artillery.

This fact need surprise no one. The Yankees, the first mechanicians in the world, are engineers—just as the Italians are musicians and the Germans metaphysicians—by right of birth. Nothing is more natural, therefore, than to perceive them applying their audacious ingenuity to the science of gunnery. Witness the marvels of Parrott, Dahlgren, and Rodman. The Armstrong, Palliser, and Beaulieu guns were compelled to bow before their transatlantic rivals.

Now when an American has an idea, he directly seeks a second American to share it. If there be three, they elect a president and two secretaries. Given four, they name a keeper of records, and the office is ready for work; five, they convene a general meeting, and the club is fully constituted. So things were managed in Baltimore. The inventor of a new cannon associ-

ated himself with the caster and the borer. Thus was formed the nucleus of the "Gun Club." In a single month after its formation it numbered 1,833 effective members and 30,565 corresponding members.

One condition was imposed as a sine qua non upon every candidate for admission into the association, and that was the condition of having designed, or (more or less) perfected a cannon; or, in default of a cannon, at least a firearm of some description. It may, however, be mentioned that mere inventors of revolvers, fire-shooting carbines, and similar small arms, met with little consideration. Artillerists always commanded the chief place of favor.

The estimation in which these gentlemen were held, according to one of the most scientific exponents of the Gun Club, was "proportional to the masses of their guns, and in the direct ratio of the square of the distances attained by their projectiles."

The Gun Club once founded, it is easy to conceive the result of the inventive genius of the Americans. Their military weapons attained colossal proportions, and their projectiles, exceeding the prescribed limits, unfortunately occasionally cut in two some unoffending pedestrians. These inventions, in fact, left far in the rear the timid instruments of European artillery.

It is but fair to add that these Yankees, brave as they have ever proved themselves to be, did not confine themselves to theories and formulae, but that they paid heavily, in propria persona, for their inventions. Among them were to be counted officers of all ranks, from lieutenants to generals; military men of every age, from those who were just making their debut in the profession of arms up to those who had grown old in the gun-carriage. Many had found their rest on the field of battle whose names figured in the "Book of Honor" of the Gun Club; and of those who made good their return the greater proportion bore the marks of their indisputable valor. Crutches, wooden legs, artificial arms, steel hooks, caoutchouc jaws, silver craniums, platinum noses, were all to be found in the collection; and it was calculated by the great statistician Pitcairn that throughout the Gun Club there was not quite one arm between four persons and two legs between six.

Nevertheless, these valiant artillerists took no particular account of these little facts, and felt justly proud when the despatches of a battle returned the number of victims at ten-fold the quantity of projectiles expended.

One day, however—sad and melancholy day!—peace was signed between the survivors of the war; the thunder of the guns gradually ceased, the mortars were silent, the howitzers were muzzled for an indefinite period, the cannon, with muzzles depressed, were returned into the ar-

senal, the shot were repiled, all bloody reminiscences were effaced; the cotton-plants grew luxuriantly in the well-manured fields, all mourning garments were laid aside, together with grief; and the Gun Club was relegated to profound inactivity.

Some few of the more advanced and inveterate theorists set themselves again to work upon calculations regarding the laws of projectiles. They reverted invariably to gigantic shells and howitzers of unparalleled caliber. Still in default of practical experience what was the value of mere theories? Consequently, the clubrooms became deserted, the servants dozed in the antechambers, the newspapers grew mouldy on the tables, sounds of snoring came from dark corners, and the members of the Gun Club, erstwhile so noisy in their seances, were reduced to silence by this disastrous peace and gave themselves up wholly to dreams of a Platonic kind of artillery.

"This is horrible!" said Tom Hunter one evening, while rapidly carbonizing his wooden legs in the fireplace of the smoking-room; "nothing to do! nothing to look forward to! what a loathsome existence! When again shall the guns arouse us in the morning with their delightful reports?"

"Those days are gone by," said jolly Bilsby, trying to extend his missing arms. "It was delightful once upon a time! One invented a gun, and hardly was it cast, when one hastened to try it in the face of the enemy! Then one returned to camp with a word of encouragement from Sherman or a friendly shake of the hand from McClellan. But now the generals are gone back to their counters; and in place of projectiles, they despatch bales of cotton. By Jove, the future of gunnery in America is lost!"

"Ay! and no war in prospect!" continued the famous James T. Maston, scratching with his steel hook his gutta-percha cranium. "Not a cloud on the horizon! and that too at such a critical period in the progress of the science of artillery! Yes, gentlemen! I who address you have myself this very morning perfected a model (plan, section, elevation, etc.) of a mortar destined to change all the conditions of warfare!"

"No! is it possible?" replied Tom Hunter, his thoughts reverting involuntarily to a former invention of the Hon. J. T. Maston, by which, at its first trial, he had succeeded in killing three hundred and thirty-seven people.

"Fact!" replied he. "Still, what is the use of so many studies worked out, so many difficulties vanquished? It's mere waste of time! The New World seems to have made up its mind to live in peace; and our bellicose Tribune predicts some approaching catastrophes arising out of this scandalous increase of population."

"Nevertheless," replied Colonel Blomsberry, "they are always struggling in Europe to maintain the principle of nationalities."

"Well?"

"Well, there might be some field for enterprise down there; and if they would accept our services—"

"What are you dreaming of?" screamed Bilsby; "work at gunnery for the benefit of foreigners?"

"That would be better than doing nothing here," returned the colonel.

"Quite so," said J. T. Matson; "but still we need not dream of that expedient."

"And why not?" demanded the colonel.

"Because their ideas of progress in the Old World are contrary to our American habits of thought. Those fellows believe that one can't become a general without having served first as an ensign; which is as much as to say that one can't point a gun without having first cast it oneself!"

"Ridiculous!" replied Tom Hunter, whittling with his bowie-knife the arms of his easy chair; "but if that be the case there, all that is left for us is to plant tobacco and distill whale-oil."

"What!" roared J. T. Maston, "shall we not employ these remaining years of our life in perfecting firearms? Shall there never be a fresh opportunity of trying the ranges of projectiles? Shall the air never again be lighted with the glare of our guns? No international difficulty ever arise to enable us to declare war against some transatlantic power? Shall not the French sink one of our steamers, or the English, in defiance of the rights of nations, hang a few of our countrymen?"

"No such luck," replied Colonel Blomsberry; "nothing of the kind is likely to happen; and even if it did, we should not profit by it. American susceptibility is fast declining, and we are all going to the dogs."

"It is too true," replied J. T. Maston, with fresh violence; "there are a thousand grounds for fighting, and yet we don't fight. We save up our arms and legs for the benefit of nations who don't know what to do with them! But stop—without going out of one's way to find a cause for war—did not North America once belong to the English?"

"Undoubtedly," replied Tom Hunter, stamping his crutch with fury.

"Well, then," replied J. T. Maston, "why should not England in her turn belong to the Americans?"

"It would be but just and fair," returned Colonel Blomsberry.

"Go and propose it to the President of the United States," cried J. T. Maston, "and see how he will receive you."

"Bah!" growled Bilsby between the four teeth which the war had left him; "that will never do!"

"By Jove!" cried J. T. Maston, "he mustn't count on my vote at the next election!"

"Nor on ours," replied unanimously all the bellicose invalids.

"Meanwhile," replied J. T. Maston, "allow me to say that, if I cannot get an opportunity to try my new mortars on a real field of battle, I shall say good-by to the members of the Gun Club, and go and bury myself in the prairies of Arkansas!"

"In that case we will accompany you," cried the others.

Matters were in this unfortunate condition, and the club was threatened with approaching dissolution, when an unexpected circumstance occurred to prevent so deplorable a catastrophe.

On the morrow after this conversation every member of the association received a sealed circular couched in the following terms:

BALTIMORE, *October 3.*

The president of the Gun Club has the honor to inform his colleagues that, at the meeting of the 5th instant, he will bring before them a communication of an extremely interesting nature. He requests, therefore, that they will make it convenient to attend in accordance with the present invitation.

Very cordially,
IMPEY BARBICANE, P.G.C.

II

President Barbicane's Communication

On the 5th of October, at eight p.m., a dense crowd pressed toward the saloons of the Gun Club at No. 21 Union Square. All the members of the association resident in Baltimore attended the invitation of their president. As regards the corresponding members, notices were delivered by hundreds throughout the streets of the city, and, large as was the great hall, it was quite inadequate to accommodate the crowd of savants. They overflowed into the adjoining rooms, down the narrow passages, into the outer courtyards. There they ran against the vulgar herd who pressed up to the doors, each struggling to reach the front ranks, all eager to learn the nature of the important communication of President Barbicane; all pushing, squeezing, crushing with that perfect freedom of action which is so peculiar to the masses when educated in ideas of "self-government."

On that evening a stranger who might have chanced to be in Baltimore could not have gained admission for love or money into the great

hall. That was reserved exclusively for resident or corresponding members; no one else could possibly have obtained a place; and the city magnates, municipal councilors, and "select men" were compelled to mingle with the mere townspeople in order to catch stray bits of news from the interior.

Nevertheless the vast hall presented a curious spectacle. Its immense area was singularly adapted to the purpose. Lofty pillars formed of cannon, superposed upon huge mortars as a base, supported the fine ironwork of the arches, a perfect piece of cast-iron lacework. Trophies of blunderbuses, matchlocks, arquebuses, carbines, all kinds of firearms, ancient and modern, were picturesquely interlaced against the walls. The gas lit up in full glare myriads of revolvers grouped in the form of lustres, while groups of pistols, and candelabra formed of muskets bound together, completed this magnificent display of brilliance. Models of cannon, bronze castings, sights covered with dents, plates battered by the shots of the Gun Club, assortments of rammers and sponges, chaplets of shells, wreaths of projectiles, garlands of howitzers—in short, all the apparatus of the artillerist, enchanted the eye by this wonderful arrangement and induced a kind of belief that their real purpose was ornamental rather than deadly.

At the further end of the saloon the president, assisted by four secretaries, occupied a large platform. His chair, supported by a carved gun-carriage, was modeled upon the ponderous proportions of a 32-inch mortar. It was pointed at an angle of ninety degrees, and suspended upon truncheons, so that the president could balance himself upon it as upon a rocking-chair, a very agreeable fact in the very hot weather. Upon the table (a huge iron plate supported upon six carronades) stood an inkstand of exquisite elegance, made of a beautifully chased Spanish piece, and a sonnette, which, when required, could give forth a report equal to that of a revolver. During violent debates this novel kind of bell scarcely sufficed to drown the clamor of these excitable artillerists.

In front of the table benches arranged in zigzag form, like the circumvallations of a retrenchment, formed a succession of bastions and curtains set apart for the use of the members of the club; and on this especial evening one might say, "All the world was on the ramparts." The president was sufficiently well known, however, for all to be assured that he would not put his colleagues to discomfort without some very strong motive.

Impey Barbicane was a man of forty years of age, calm, cold, austere; of a singularly serious and self-contained demeanor, punctual as a chronometer, of imperturbable temper and immovable character; by no means chivalrous, yet adventurous withal, and always bringing practical ideas to bear upon the very rashest enterprises; an essentially New Englander, a Northern colonist, a descendant of the old anti-Stuart Roundheads, and

the implacable enemy of the gentlemen of the South, those ancient cavaliers of the mother country. In a word, he was a Yankee to the backbone.

Barbicane had made a large fortune as a timber merchant. Being nominated director of artillery during the war, he proved himself fertile in invention. Bold in his conceptions, he contributed powerfully to the progress of that arm and gave an immense impetus to experimental researches.

He was personage of the middle height, having, by a rare exception in the Gun Club, all his limbs complete. His strongly marked features seemed drawn by square and rule; and if it be true that, in order to judge a man's character one must look at his profile, Barbicane, so examined, exhibited the most certain indications of energy, audacity, and sang-froid.

At this moment he was sitting in his armchair, silent, absorbed, lost in reflection, sheltered under his high-crowned hat—a kind of black cylinder which always seems firmly screwed upon the head of an American.

Just when the deep-toned clock in the great hall struck eight, Barbicane, as if he had been set in motion by a spring, raised himself up. A profound silence ensued, and the speaker, in a somewhat emphatic tone of voice, commenced as follows:

"My brave, colleagues, too long already a paralyzing peace has plunged the members of the Gun Club in deplorable inactivity. After a period of years full of incidents we have been compelled to abandon our labors, and to stop short on the road of progress. I do not hesitate to state, baldly, that any war which would recall us to arms would be welcome!" (Tremendous applause!) "But war, gentlemen, is impossible under existing circumstances; and, however we may desire it, many years may elapse before our cannon shall again thunder in the field of battle. We must make up our minds, then, to seek in another train of ideas some field for the activity which we all pine for."

The meeting felt that the president was now approaching the critical point, and redoubled their attention accordingly.

"For some months past, my brave colleagues," continued Barbicane, "I have been asking myself whether, while confining ourselves to our own particular objects, we could not enter upon some grand experiment worthy of the nineteenth century; and whether the progress of artillery science would not enable us to carry it out to a successful issue. I have been considering, working, calculating; and the result of my studies is the conviction that we are safe to succeed in an enterprise which to any other country would appear wholly impracticable. This project, the result of long elaboration, is the object of my present communication. It is worthy of yourselves, worthy of the antecedents of the Gun Club; and it cannot fail to make some noise in the world."

A thrill of excitement ran through the meeting.

Barbicane, having by a rapid movement firmly fixed his hat upon his head, calmly continued his harangue:

"There is no one among you, my brave colleagues, who has not seen the Moon, or, at least, heard speak of it. Don't be surprised if I am about to discourse to you regarding the Queen of the Night. It is perhaps reserved for us to become the Columbuses of this unknown world. Only enter into my plans, and second me with all your power, and I will lead you to its conquest, and its name shall be added to those of the thirty-six states which compose this Great Union."

"Three cheers for the Moon!" roared the Gun Club, with one voice.

"The moon, gentlemen, has been carefully studied," continued Barbicane; "her mass, density, and weight; her constitution, motions, distance, as well as her place in the solar system, have all been exactly determined. Selenographic charts have been constructed with a perfection which equals, if it does not even surpass, that of our terrestrial maps. Photography has given us proofs of the incomparable beauty of our satellite; all is known regarding the moon which mathematical science, astronomy, geology, and optics can learn about her. But up to the present moment no direct communication has been established with her."

A violent movement of interest and surprise here greeted this remark of the speaker.

"Permit me," he continued, "to recount to you briefly how certain ardent spirits, starting on imaginary journeys, have penetrated the secrets of our satellite. In the seventeenth century a certain David Fabricius boasted of having seen with his own eyes the inhabitants of the moon. In 1649 a Frenchman, one Jean Baudoin, published a 'Journey performed from the Earth to the Moon by Domingo Gonzalez,' a Spanish adventurer. At the same period Cyrano de Bergerac published that celebrated 'Journeys in the Moon' which met with such success in France. Somewhat later another Frenchman, named Fontenelle, wrote 'The Plurality of Worlds,' a chef-d'oeuvre of its time. About 1835 a small treatise, translated from the New York American, related how Sir John Herschel, having been despatched to the Cape of Good Hope for the purpose of making there some astronomical calculations, had, by means of a telescope brought to perfection by means of internal lighting, reduced the apparent distance of the moon to eighty yards! He then distinctly perceived caverns frequented by hippopotami, green mountains bordered by golden lace-work, sheep with horns of ivory, a white species of deer and inhabitants with membranous wings, like bats. This brochure, the work of an American named Locke, had a great sale. But, to bring this rapid sketch to a close, I will only add that

a certain Hans Pfaal, of Rotterdam, launching himself in a balloon filled with a gas extracted from nitrogen, thirty-seven times lighter than hydrogen, reached the moon after a passage of nineteen hours. This journey, like all previous ones, was purely imaginary; still, it was the work of a popular American author—I mean Edgar Poe!"

"Cheers for Edgar Poe!" roared the assemblage, electrified by their president's words.

"I have now enumerated," said Barbicane, "the experiments which I call purely paper ones, and wholly insufficient to establish serious relations with the Queen of the Night. Nevertheless, I am bound to add that some practical geniuses have attempted to establish actual communication with her. Thus, a few days ago, a German geometrician proposed to send a scientific expedition to the steppes of Siberia. There, on those vast plains, they were to describe enormous geometric figures, drawn in characters of reflecting luminosity, among which was the proposition regarding the 'square of the hypothenuse,' commonly called the 'Ass's Bridge' by the French. 'Every intelligent being,' said the geometrician, 'must understand the scientific meaning of that figure. The Selenites, do they exist, will respond by a similar figure; and, a communication being thus once established, it will be easy to form an alphabet which shall enable us to converse with the inhabitants of the moon.' So spoke the German geometrician; but his project was never put into practice, and up to the present day there is no bond in existence between the Earth and her satellite. It is reserved for the practical genius of Americans to establish a communication with the sidereal world. The means of arriving thither are simple, easy, certain, infallible—and that is the purpose of my present proposal."

A storm of acclamations greeted these words. There was not a single person in the whole audience who was not overcome, carried away, lifted out of himself by the speaker's words!

Long-continued applause resounded from all sides.

As soon as the excitement had partially subsided, Barbicane resumed his speech in a somewhat graver voice.

"You know," said he, "what progress artillery science has made during the last few years, and what a degree of perfection firearms of every kind have reached. Moreover, you are well aware that, in general terms, the resisting power of cannon and the expansive force of gunpowder are practically unlimited. Well! starting from this principle, I ask myself whether, supposing sufficient apparatus could be obtained constructed upon the conditions of ascertained resistance, it might not be possible to project a shot up to the moon?"

At these words a murmur of amazement escaped from a thousand panting chests; then succeeded a moment of perfect silence, resembling that profound stillness which precedes the bursting of a thunderstorm. In point of fact, a thunderstorm did peal forth, but it was the thunder of applause, or cries, and of uproar which made the very hall tremble. The president attempted to speak, but could not. It was fully ten minutes before he could make himself heard.

"Suffer me to finish," he calmly continued. "I have looked at the question in all its bearings, I have resolutely attacked it, and by incontrovertible calculations I find that a projectile endowed with an initial velocity of 12,000 yards per second, and aimed at the moon, must necessarily reach it. I have the honor, my brave colleagues, to propose a trial of this little experiment."

III

Effect of the President's Communication

It is impossible to describe the effect produced by the last words of the honorable president—the cries, the shouts, the succession of roars, hurrahs, and all the varied vociferations which the American language is capable of supplying. It was a scene of indescribable confusion and uproar. They shouted, they clapped, they stamped on the floor of the hall. All the weapons in the museum discharged at once could not have more violently set in motion the waves of sound. One need not be surprised at this. There are some cannoneers nearly as noisy as their own guns.

Barbicane remained calm in the midst of this enthusiastic clamor; perhaps he was desirous of addressing a few more words to his colleagues, for by his gestures he demanded silence, and his powerful alarum was worn out by its violent reports. No attention, however, was paid to his request. He was presently torn from his seat and passed from the hands of his faithful colleagues into the arms of a no less excited crowd.

Nothing can astound an American. It has often been asserted that the word "impossible" in not a French one. People have evidently been deceived by the dictionary. In America, all is easy, all is simple; and as for mechanical difficulties, they are overcome before they arise. Between Barbicane's proposition and its realization no true Yankee would have al-

lowed even the semblance of a difficulty to be possible. A thing with them is no sooner said than done.

The triumphal progress of the president continued throughout the evening. It was a regular torchlight procession. Irish, Germans, French, Scotch, all the heterogeneous units which make up the population of Maryland shouted in their respective vernaculars; and the "vivas," "hurrahs," and "bravos" were intermingled in inexpressible enthusiasm.

Just at this crisis, as though she comprehended all this agitation regarding herself, the moon shone forth with serene splendor, eclipsing by her intense illumination all the surrounding lights. The Yankees all turned their gaze toward her resplendent orb, kissed their hands, called her by all kinds of endearing names. Between eight o'clock and midnight one optician in Jones'-Fall Street made his fortune by the sale of opera-glasses.

Midnight arrived, and the enthusiasm showed no signs of diminution. It spread equally among all classes of citizens—men of science, shopkeepers, merchants, porters, chair-men, as well as "greenhorns," were stirred in their innermost fibres. A national enterprise was at stake. The whole city, high and low, the quays bordering the Patapsco, the ships lying in the basins, disgorged a crowd drunk with joy, gin, and whisky. Every one chattered, argued, discussed, disputed, applauded, from the gentleman lounging upon the barroom settee with his tumbler of sherry-cobbler before him down to the waterman who got drunk upon his "knock-me-down" in the dingy taverns of Fell Point.

About two A.M., however, the excitement began to subside. President Barbicane reached his house, bruised, crushed, and squeezed almost to a mummy. Hercules could not have resisted a similar outbreak of enthusiasm. The crowd gradually deserted the squares and streets. The four railways from Philadelphia and Washington, Harrisburg and Wheeling, which converge at Baltimore, whirled away the heterogeneous population to the four corners of the United States, and the city subsided into comparative tranquility.

On the following day, thanks to the telegraphic wires, five hundred newspapers and journals, daily, weekly, monthly, or bi-monthly, all took up the question. They examined it under all its different aspects, physical, meteorological, economical, or moral, up to its bearings on politics or civilization. They debated whether the moon was a finished world, or whether it was destined to undergo any further transformation. Did it resemble the earth at the period when the latter was destitute as yet of an atmosphere? What kind of spectacle would its hidden hemisphere present to our terrestrial spheroid? Granting that the question at present was simply that of sending a projectile up to the moon, every one must

see that that involved the commencement of a series of experiments. All must hope that some day America would penetrate the deepest secrets of that mysterious orb; and some even seemed to fear lest its conquest should not sensibly derange the equilibrium of Europe.

The project once under discussion, not a single paragraph suggested a doubt of its realization. All the papers, pamphlets, reports—all the journals published by the scientific, literary, and religious societies enlarged upon its advantages; and the Society of Natural History of Boston, the Society of Science and Art of Albany, the Geographical and Statistical Society of New York, the Philosophical Society of Philadelphia, and the Smithsonian of Washington sent innumerable letters of congratulation to the Gun Club, together with offers of immediate assistance and money.

From that day forward Impey Barbicane became one of the greatest citizens of the United States, a kind of Washington of science. A single trait of feeling, taken from many others, will serve to show the point which this homage of a whole people to a single individual attained.

Some few days after this memorable meeting of the Gun Club, the manager of an English company announced, at the Baltimore theatre, the production of "Much ado about Nothing." But the populace, seeing in that title an allusion damaging to Barbicane's project, broke into the auditorium, smashed the benches, and compelled the unlucky director to alter his playbill. Being a sensible man, he bowed to the public will and replaced the offending comedy by "As you like it"; and for many weeks he realized fabulous profits.

IV

Reply From the Observatory of Cambridge

Barbicane, however, lost not one moment amid all the enthusiasm of which he had become the object. His first care was to reassemble his colleagues in the board-room of the Gun Club. There, after some discussion, it was agreed to consult the astronomers regarding the astronomical part of the enterprise. Their reply once ascertained, they could then discuss the mechanical means, and nothing should be wanting to ensure the success of this great experiment.

A note couched in precise terms, containing special interrogatories, was then drawn up and addressed to the Observatory of Cambridge in

Massachusetts. This city, where the first university of the United States was founded, is justly celebrated for its astronomical staff. There are to be found assembled all the most eminent men of science. Here is to be seen at work that powerful telescope which enabled Bond to resolve the nebula of Andromeda, and Clarke to discover the satellite of Sirius. This celebrated institution fully justified on all points the confidence reposed in it by the Gun Club. So, after two days, the reply so impatiently awaited was placed in the hands of President Barbicane.

It was couched in the following terms:

THE DIRECTOR OF THE CAMBRIDGE OBSERVATORY TO THE PRESIDENT OF THE GUN CLUB AT BALTIMORE.

CAMBRIDGE, *October 7.*

On the receipt of your favor of the 6th instant, addressed to the Observatory of Cambridge in the name of the members of the Baltimore Gun Club, our staff was immediately called together, and it was judged expedient to reply as follows:

The questions which have been proposed to it are these—

"1. Is it possible to transmit a projectile up to the moon?

"2. What is the exact distance which separates the earth from its satellite?

"3. What will be the period of transit of the projectile when endowed with sufficient initial velocity? and, consequently, at what moment ought it to be discharged in order that it may touch the moon at a particular point?

"4. At what precise moment will the moon present herself in the most favorable position to be reached by the projectile?

"5. What point in the heavens ought the cannon to be aimed at which is intended to discharge the projectile?

"6. What place will the moon occupy in the heavens at the moment of the projectile's departure?"

Regarding the first question, "Is it possible to transmit a projectile up to the moon?"

ANSWER:—Yes; provided it possess an initial velocity of 1,200 yards per second; calculations prove that to be sufficient. In proportion as we recede from the earth the action of gravitation diminishes in the inverse ratio of the square of the distance; that is to say, at three times a given distance the action is nine times less. Consequently, the weight of a shot will decrease, and will become reduced to zero at the instant that the attraction of the moon exactly counterpoises that of the earth; that is to say at 47/52 of its passage. At that instant the projectile will have no

weight whatever; and, if it passes that point, it will fall into the moon by the sole effect of the lunar attraction. The theoretical possibility of the experiment is therefore absolutely demonstrated; its success must depend upon the power of the engine employed.

As to the second question, "What is the exact distance which separates the earth from its satellite?"

ANSWER:—The moon does not describe a circle round the earth, but rather an ellipse, of which our earth occupies one of the foci; the consequence, therefore, is, that at certain times it approaches nearer to, and at others it recedes farther from, the earth; in astronomical language, it is at one time in apogee, at another in perigee. Now the difference between its greatest and its least distance is too considerable to be left out of consideration. In point of fact, in its apogee the moon is 247,552 miles, and in its perigee, 218,657 miles only distant; a fact which makes a difference of 28,895 miles, or more than one-ninth of the entire distance. The perigee distance, therefore, is that which ought to serve as the basis of all calculations.

To the third question.

ANSWER:—If the shot should preserve continuously its initial velocity of 12,000 yards per second, it would require little more than nine hours to reach its destination; but, inasmuch as that initial velocity will be continually decreasing, it will occupy 300,000 seconds, that is 83hrs. 20m. in reaching the point where the attraction of the earth and moon will be in equilibrio. From this point it will fall into the moon in 50,000 seconds, or 13hrs. 53m. 20sec. It will be desirable, therefore, to discharge it 97hrs. 13m. 20sec. before the arrival of the moon at the point aimed at.

Regarding question four, "At what precise moment will the moon present herself in the most favorable position, etc.?"

ANSWER:—After what has been said above, it will be necessary, first of all, to choose the period when the moon will be in perigee, and also the moment when she will be crossing the zenith, which latter event will further diminish the entire distance by a length equal to the radius of the earth, i. e. 3,919 miles; the result of which will be that the final passage remaining to be accomplished will be 214,976 miles. But although the moon passes her perigee every month, she does not reach the zenith always at exactly the same moment. She does not appear under these two conditions simultaneously, except at long intervals of time. It will be necessary, therefore, to wait for the moment when her passage in perigee shall coincide with that in the zenith. Now, by a fortunate circumstance, on the 4th of December in the ensuing year the moon will present these two conditions. At midnight she will be in perigee, that

is, at her shortest distance from the earth, and at the same moment she will be crossing the zenith.

On the fifth question, "At what point in the heavens ought the cannon to be aimed?"

ANSWER:—The preceding remarks being admitted, the cannon ought to be pointed to the zenith of the place. Its fire, therefore, will be perpendicular to the plane of the horizon; and the projectile will soonest pass beyond the range of the terrestrial attraction. But, in order that the moon should reach the zenith of a given place, it is necessary that the place should not exceed in latitude the declination of the luminary; in other words, it must be comprised within the degrees 0@ and 28@ of lat. N. or S. In every other spot the fire must necessarily be oblique, which would seriously militate against the success of the experiment.

As to the sixth question, "What place will the moon occupy in the heavens at the moment of the projectile's departure?"

ANSWER:—At the moment when the projectile shall be discharged into space, the moon, which travels daily forward 13@ 10' 35", will be distant from the zenith point by four times that quantity, i. e. by 52@ 41' 20", a space which corresponds to the path which she will describe during the entire journey of the projectile. But, inasmuch as it is equally necessary to take into account the deviation which the rotary motion of the earth will impart to the shot, and as the shot cannot reach the moon until after a deviation equal to 16 radii of the earth, which, calculated upon the moon's orbit, are equal to about eleven degrees, it becomes necessary to add these eleven degrees to those which express the retardation of the moon just mentioned: that is to say, in round numbers, about sixty-four degrees. Consequently, at the moment of firing the visual radius applied to the moon will describe, with the vertical line of the place, an angle of sixty-four degrees.

These are our answers to the questions proposed to the Observatory of Cambridge by the members of the Gun Club:

To sum up—

1st. The cannon ought to be planted in a country situated between 0@ and 28@ of N. or S. lat.

2nd. It ought to be pointed directly toward the zenith of the place.

3rd. The projectile ought to be propelled with an initial velocity of 12,000 yards per second.

4th. It ought to be discharged at 10hrs. 46m. 40sec. of the 1st of December of the ensuing year.

5th. It will meet the moon four days after its discharge, precisely at midnight on the 4th of December, at the moment of its transit across the zenith.

The members of the Gun Club ought, therefore, without delay, to commence the works necessary for such an experiment, and to be prepared to set to work at the moment determined upon; for, if they should suffer this 4th of December to go by, they will not find the moon again under the same conditions of perigee and of zenith until eighteen years and eleven days afterward.

The staff of the Cambridge Observatory place themselves entirely at their disposal in respect of all questions of theoretical astronomy; and herewith add their congratulations to those of all the rest of America.

For the Astronomical Staff,
J. M. BELFAST,
Director of the Observatory of Cambridge.

V

The Romance of the Moon

An observer endued with an infinite range of vision, and placed in that unknown center around which the entire world revolves, might have beheld myriads of atoms filling all space during the chaotic epoch of the universe. Little by little, as ages went on, a change took place; a general law of attraction manifested itself, to which the hitherto errant atoms became obedient: these atoms combined together chemically according to their affinities, formed themselves into molecules, and composed those nebulous masses with which the depths of the heavens are strewed. These masses became immediately endued with a rotary motion around their own central point. This center, formed of indefinite molecules, began to revolve around its own axis during its gradual condensation; then, following the immutable laws of mechanics, in proportion as its bulk diminished by condensation, its rotary motion became accelerated, and these two effects continuing, the result was the formation of one principal star, the center of the nebulous mass.

By attentively watching, the observer would then have perceived the other molecules of the mass, following the example of this central star, become likewise condensed by gradually accelerated rotation, and gravi-

tating round it in the shape of innumerable stars. Thus was formed the Nebulae, of which astronomers have reckoned up nearly 5,000.

Among these 5,000 nebulae there is one which has received the name of the Milky Way, and which contains eighteen millions of stars, each of which has become the center of a solar world.

If the observer had then specially directed his attention to one of the more humble and less brilliant of these stellar bodies, a star of the fourth class, that which is arrogantly called the Sun, all the phenomena to which the formation of the Universe is to be ascribed would have been successively fulfilled before his eyes. In fact, he would have perceived this sun, as yet in the gaseous state, and composed of moving molecules, revolving round its axis in order to accomplish its work of concentration. This motion, faithful to the laws of mechanics, would have been accelerated with the diminution of its volume; and a moment would have arrived when the centrifugal force would have overpowered the centripetal, which causes the molecules all to tend toward the center.

Another phenomenon would now have passed before the observer's eye, and the molecules situated on the plane of the equator, escaping like a stone from a sling of which the cord had suddenly snapped, would have formed around the sun sundry concentric rings resembling that of Saturn. In their turn, again, these rings of cosmical matter, excited by a rotary motion about the central mass, would have been broken up and decomposed into secondary nebulosities, that is to say, into planets. Similarly he would have observed these planets throw off one or more rings each, which became the origin of the secondary bodies which we call satellites.

Thus, then, advancing from atom to molecule, from molecule to nebulous mass, from that to principal star, from star to sun, from sun to planet, and hence to satellite, we have the whole series of transformations undergone by the heavenly bodies during the first days of the world.

Now, of those attendant bodies which the sun maintains in their elliptical orbits by the great law of gravitation, some few in turn possess satellites. Uranus has eight, Saturn eight, Jupiter four, Neptune possibly three, and the Earth one. This last, one of the least important of the entire solar system, we call the Moon; and it is she whom the daring genius of the Americans professed their intention of conquering.

The moon, by her comparative proximity, and the constantly varying appearances produced by her several phases, has always occupied a considerable share of the attention of the inhabitants of the earth.

From the time of Thales of Miletus, in the fifth century B.C., down to that of Copernicus in the fifteenth and Tycho Brahe in the sixteenth century A.D., observations have been from time to time carried on with

more or less correctness, until in the present day the altitudes of the lunar mountains have been determined with exactitude. Galileo explained the phenomena of the lunar light produced during certain of her phases by the existence of mountains, to which he assigned a mean altitude of 27,000 feet. After him Hevelius, an astronomer of Dantzic, reduced the highest elevations to 15,000 feet; but the calculations of Riccioli brought them up again to 21,000 feet.

At the close of the eighteenth century Herschel, armed with a powerful telescope, considerably reduced the preceding measurements. He assigned a height of 11,400 feet to the maximum elevations, and reduced the mean of the different altitudes to little more than 2,400 feet. But Herschel's calculations were in their turn corrected by the observations of Halley, Nasmyth, Bianchini, Gruithuysen, and others; but it was reserved for the labors of Boeer and Maedler finally to solve the question. They succeeded in measuring 1,905 different elevations, of which six exceed 15,000 feet, and twenty-two exceed 14,400 feet. The highest summit of all towers to a height of 22,606 feet above the surface of the lunar disc. At the same period the examination of the moon was completed. She appeared completely riddled with craters, and her essentially volcanic character was apparent at each observation. By the absence of refraction in the rays of the planets occulted by her we conclude that she is absolutely devoid of an atmosphere. The absence of air entails the absence of water. It became, therefore, manifest that the Selenites, to support life under such conditions, must possess a special organization of their own, must differ remarkably from the inhabitants of the earth.

At length, thanks to modern art, instruments of still higher perfection searched the moon without intermission, not leaving a single point of her surface unexplored; and notwithstanding that her diameter measures 2,150 miles, her surface equals the one-fifteenth part of that of our globe, and her bulk the one-forty-ninth part of that of the terrestrial spheroid—not one of her secrets was able to escape the eyes of the astronomers; and these skillful men of science carried to an even greater degree their prodigious observations.

Thus they remarked that, during full moon, the disc appeared scored in certain parts with white lines; and, during the phases, with black. On prosecuting the study of these with still greater precision, they succeeded in obtaining an exact account of the nature of these lines. They were long and narrow furrows sunk between parallel ridges, bordering generally upon the edges of the craters. Their length varied between ten and 100 miles, and their width was about 1,600 yards. Astronomers called them chasms, but they could not get any further. Whether these

chasms were the dried-up beds of ancient rivers or not they were unable thoroughly to ascertain.

The Americans, among others, hoped one day or other to determine this geological question. They also undertook to examine the true nature of that system of parallel ramparts discovered on the moon's surface by Gruithuysen, a learned professor of Munich, who considered them to be "a system of fortifications thrown up by the Selenitic engineers." These two points, yet obscure, as well as others, no doubt, could not be definitely settled except by direct communication with the moon.

Regarding the degree of intensity of its light, there was nothing more to learn on this point. It was known that it is 300,000 times weaker than that of the sun, and that its heat has no appreciable effect upon the thermometer. As to the phenomenon known as the "ashy light," it is explained naturally by the effect of the transmission of the solar rays from the earth to the moon, which give the appearance of completeness to the lunar disc, while it presents itself under the crescent form during its first and last phases.

Such was the state of knowledge acquired regarding the earth's satellite, which the Gun Club undertook to perfect in all its aspects, cosmographic, geological, political, and moral.

VI

Permissive Limits of Ignorance and Belief in the United States

The immediate result of Barbicane's proposition was to place upon the orders of the day all the astronomical facts relative to the Queen of the Night. Everybody set to work to study assiduously. One would have thought that the moon had just appeared for the first time, and that no one had ever before caught a glimpse of her in the heavens. The papers revived all the old anecdotes in which the "sun of the wolves" played a part; they recalled the influences which the ignorance of past ages ascribed to her; in short, all America was seized with selenomania, or had become moon-mad.

The scientific journals, for their part, dealt more especially with the questions which touched upon the enterprise of the Gun Club. The letter

of the Observatory of Cambridge was published by them, and commented upon with unreserved approval.

Until that time most people had been ignorant of the mode in which the distance which separates the moon from the earth is calculated. They took advantage of this fact to explain to them that this distance was obtained by measuring the parallax of the moon. The term parallax proving "caviare to the general," they further explained that it meant the angle formed by the inclination of two straight lines drawn from either extremity of the earth's radius to the moon. On doubts being expressed as to the correctness of this method, they immediately proved that not only was the mean distance 234,347 miles, but that astronomers could not possibly be in error in their estimate by more than seventy miles either way.

To those who were not familiar with the motions of the moon, they demonstrated that she possesses two distinct motions, the first being that of rotation upon her axis, the second being that of revolution round the earth, accomplishing both together in an equal period of time, that is to say, in twenty-seven and one-third days.

The motion of rotation is that which produces day and night on the surface of the moon; save that there is only one day and one night in the lunar month, each lasting three hundred and fifty-four and one-third hours. But, happily for her, the face turned toward the terrestrial globe is illuminated by it with an intensity equal to that of fourteen moons. As to the other face, always invisible to us, it has of necessity three hundred and fifty-four hours of absolute night, tempered only by that "pale glimmer which falls upon it from the stars."

Some well-intentioned, but rather obstinate persons, could not at first comprehend how, if the moon displays invariably the same face to the earth during her revolution, she can describe one turn round herself. To such they answered, "Go into your dining-room, and walk round the table in such a way as to always keep your face turned toward the center; by the time you will have achieved one complete round you will have completed one turn around yourself, since your eye will have traversed successively every point of the room. Well, then, the room is the heavens, the table is the earth, and the moon is yourself." And they would go away delighted.

So, then the moon displays invariably the same face to the earth; nevertheless, to be quite exact, it is necessary to add that, in consequence of certain fluctuations of north and south, and of west and east, termed her libration, she permits rather more than half, that is to say, five-sevenths, to be seen.

As soon as the ignoramuses came to understand as much as the director of the observatory himself knew, they began to worry themselves

regarding her revolution round the earth, whereupon twenty scientific reviews immediately came to the rescue. They pointed out to them that the firmament, with its infinitude of stars, may be considered as one vast dial-plate, upon which the moon travels, indicating the true time to all the inhabitants of the earth; that it is during this movement that the Queen of Night exhibits her different phases; that the moon is full when she is in opposition with the sun, that is when the three bodies are on the same straight line, the earth occupying the center; that she is new when she is in conjunction with the sun, that is, when she is between it and the earth; and, lastly that she is in her first or last quarter, when she makes with the sun and the earth an angle of which she herself occupies the apex.

Regarding the altitude which the moon attains above the horizon, the letter of the Cambridge Observatory had said all that was to be said in this respect. Every one knew that this altitude varies according to the latitude of the observer. But the only zones of the globe in which the moon passes the zenith, that is, the point directly over the head of the spectator, are of necessity comprised between the twenty-eighth parallels and the equator. Hence the importance of the advice to try the experiment upon some point of that part of the globe, in order that the projectile might be discharged perpendicularly, and so the soonest escape the action of gravitation. This was an essential condition to the success of the enterprise, and continued actively to engage the public attention.

Regarding the path described by the moon in her revolution round the earth, the Cambridge Observatory had demonstrated that this path is a re-entering curve, not a perfect circle, but an ellipse, of which the earth occupies one of the foci. It was also well understood that it is farthest removed from the earth during its apogee, and approaches most nearly to it at its perigee.

Such was then the extent of knowledge possessed by every American on the subject, and of which no one could decently profess ignorance. Still, while these principles were being rapidly disseminated many errors and illusory fears proved less easy to eradicate.

For instance, some worthy persons maintained that the moon was an ancient comet which, in describing its elongated orbit round the sun, happened to pass near the earth, and became confined within her circle of attraction. These drawing-room astronomers professed to explain the charred aspect of the moon—a disaster which they attributed to the intensity of the solar heat; only, on being reminded that comets have an atmosphere, and that the moon has little or none, they were fairly at a loss for a reply.

Others again, belonging to the doubting class, expressed certain fears as to the position of the moon. They had heard it said that, according to

observations made in the time of the Caliphs, her revolution had become accelerated in a certain degree. Hence they concluded, logically enough, that an acceleration of motion ought to be accompanied by a corresponding diminution in the distance separating the two bodies; and that, supposing the double effect to be continued to infinity, the moon would end by one day falling into the earth. However, they became reassured as to the fate of future generations on being apprised that, according to the calculations of Laplace, this acceleration of motion is confined within very restricted limits, and that a proportional diminution of speed will be certain to succeed it. So, then, the stability of the solar system would not be deranged in ages to come.

There remains but the third class, the superstitious. These worthies were not content merely to rest in ignorance; they must know all about things which had no existence whatever, and as to the moon, they had long known all about her. One set regarded her disc as a polished mirror, by means of which people could see each other from different points of the earth and interchange their thoughts. Another set pretended that out of one thousand new moons that had been observed, nine hundred and fifty had been attended with remarkable disturbances, such as cataclysms, revolutions, earthquakes, the deluge, etc. Then they believed in some mysterious influence exercised by her over human destinies—that every Selenite was attached to some inhabitant of the earth by a tie of sympathy; they maintained that the entire vital system is subject to her control, etc. But in time the majority renounced these vulgar errors, and espoused the true side of the question. As for the Yankees, they had no other ambition than to take possession of this new continent of the sky, and to plant upon the summit of its highest elevation the star-spangled banner of the United States of America.

VII

The Hymn of the Cannon-Ball

The Observatory of Cambridge in its memorable letter had treated the question from a purely astronomical point of view. The mechanical part still remained.

President Barbicane had, without loss of time, nominated a working committee of the Gun Club. The duty of this committee was to resolve

the three grand questions of the cannon, the projectile, and the powder. It was composed of four members of great technical knowledge, Barbicane (with a casting vote in case of equality), General Morgan, Major Elphinstone, and J. T. Maston, to whom were confided the functions of secretary. On the 8th of October the committee met at the house of President Barbicane, 3 Republican Street. The meeting was opened by the president himself.

"Gentlemen," said he, "we have to resolve one of the most important problems in the whole of the noble science of gunnery. It might appear, perhaps, the most logical course to devote our first meeting to the discussion of the engine to be employed. Nevertheless, after mature consideration, it has appeared to me that the question of the projectile must take precedence of that of the cannon, and that the dimensions of the latter must necessarily depend on those of the former."

"Suffer me to say a word," here broke in J. T. Maston. Permission having been granted, "Gentlemen," said he with an inspired accent, "our president is right in placing the question of the projectile above all others. The ball we are about to discharge at the moon is our ambassador to her, and I wish to consider it from a moral point of view. The cannon-ball, gentlemen, to my mind, is the most magnificent manifestation of human power. If Providence has created the stars and the planets, man has called the cannon-ball into existence. Let Providence claim the swiftness of electricity and of light, of the stars, the comets, and the planets, of wind and sound—we claim to have invented the swiftness of the cannon-ball, a hundred times superior to that of the swiftest horses or railway train. How glorious will be the moment when, infinitely exceeding all hitherto attained velocities, we shall launch our new projectile with the rapidity of seven miles a second! Shall it not, gentlemen—shall it not be received up there with the honors due to a terrestrial ambassador?"

Overcome with emotion the orator sat down and applied himself to a huge plate of sandwiches before him.

"And now," said Barbicane, "let us quit the domain of poetry and come direct to the question."

"By all means," replied the members, each with his mouth full of sandwich.

"The problem before us," continued the president, "is how to communicate to a projectile a velocity of 12,000 yards per second. Let us at present examine the velocities hitherto attained. General Morgan will be able to enlighten us on this point."

"And the more easily," replied the general, "that during the war I was a member of the committee of experiments. I may say, then, that the 100-

pounder Dahlgrens, which carried a distance of 5,000 yards, impressed upon their projectile an initial velocity of 500 yards a second. The Rodman Columbiad threw a shot weighing half a ton a distance of six miles, with a velocity of 800 yards per second—a result which Armstrong and Palisser have never obtained in England."

"This," replied Barbicane, "is, I believe, the maximum velocity ever attained?"

"It is so," replied the general.

"Ah!" groaned J. T. Maston, "if my mortar had not burst—"

"Yes," quietly replied Barbicane, "but it did burst. We must take, then, for our starting point, this velocity of 800 yards. We must increase it twenty-fold. Now, reserving for another discussion the means of producing this velocity, I will call your attention to the dimensions which it will be proper to assign to the shot. You understand that we have nothing to do here with projectiles weighing at most but half a ton."

"Why not?" demanded the major.

"Because the shot," quickly replied J. T. Maston, "must be big enough to attract the attention of the inhabitants of the moon, if there are any?"

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

"What mean you?" asked the major.

"I mean that it is not enough to discharge a projectile, and then take no further notice of it; we must follow it throughout its course, up to the moment when it shall reach its goal."

"What?" shouted the general and the major in great surprise.

"Undoubtedly," replied Barbicane composedly, "or our experiment would produce no result."

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

"No! Be so good as to listen. You know that optical instruments have acquired great perfection; with certain instruments we have succeeded in obtaining enlargements of 6,000 times and reducing the moon to within forty miles' distance. Now, at this distance, any objects sixty feet square would be perfectly visible.

"If, then, the penetrative power of telescopes has not been further increased, it is because that power detracts from their light; and the moon, which is but a reflecting mirror, does not give back sufficient light to enable us to perceive objects of lesser magnitude."

"Well, then, what do you propose to do?" asked the general. "Would you give your projectile a diameter of sixty feet?"

"Not so."

"Do you intend, then, to increase the luminous power of the moon?"

"Exactly so. If I can succeed in diminishing the density of the atmosphere through which the moon's light has to travel I shall have rendered her light more intense. To effect that object it will be enough to establish a telescope on some elevated mountain. That is what we will do."

"I give it up," answered the major. "You have such a way of simplifying things. And what enlargement do you expect to obtain in this way?"

"One of 48,000 times, which should bring the moon within an apparent distance of five miles; and, in order to be visible, objects need not have a diameter of more than nine feet."

"So, then," cried J. T. Maston, "our projectile need not be more than nine feet in diameter."

"Let me observe, however," interrupted Major Elphinstone, "this will involve a weight such as—"

"My dear major," replied Barbicane, "before discussing its weight permit me to enumerate some of the marvels which our ancestors have achieved in this respect. I don't mean to pretend that the science of gunnery has not advanced, but it is as well to bear in mind that during the middle ages they obtained results more surprising, I will venture to say, than ours. For instance, during the siege of Constantinople by Mahomet II., in 1453, stone shot of 1,900 pounds weight were employed. At Malta, in the time of the knights, there was a gun of the fortress of St. Elmo which threw a projectile weighing 2,500 pounds. And, now, what is the extent of what we have seen ourselves? Armstrong guns discharging shot of 500 pounds, and the Rodman guns projectiles of half a ton! It seems, then, that if projectiles have gained in range, they have lost far more in weight. Now, if we turn our efforts in that direction, we ought to arrive, with the progress on science, at ten times the weight of the shot of Mahomet II. and the Knights of Malta."

"Clearly," replied the major; "but what metal do you calculate upon employing?"

"Simply cast iron," said General Morgan.

"But," interrupted the major, "since the weight of a shot is proportionate to its volume, an iron ball of nine feet in diameter would be of tremendous weight."

"Yes, if it were solid, not if it were hollow."

"Hollow? then it would be a shell?"

"Yes, a shell," replied Barbicane; "decidely it must be. A solid shot of 108 inches would weigh more than 200,000 pounds, a weight evidently far too great. Still, as we must reserve a certain stability for our projectile, I propose to give it a weight of 20,000 pounds."

"What, then, will be the thickness of the sides?" asked the major.

"If we follow the usual proportion," replied Morgan, "a diameter of 108 inches would require sides of two feet thickness, or less."

"That would be too much," replied Barbicane; "for you will observe that the question is not that of a shot intended to pierce an iron plate; it will suffice to give it sides strong enough to resist the pressure of the gas. The problem, therefore, is this—What thickness ought a cast-iron shell to have in order not to weight more than 20,000 pounds? Our clever secretary will soon enlighten us upon this point."

"Nothing easier." replied the worthy secretary of the committee; and, rapidly tracing a few algebraical formulae upon paper, among which n^2 and x^2 frequently appeared, he presently said:

"The sides will require a thickness of less than two inches."

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

"Clearly not!" replied the president.

"What is to be done, then?" said Elphinstone, with a puzzled air.

"Employ another metal instead of iron."

"Copper?" said Morgan.

"No! that would be too heavy. I have better than that to offer."

"What then?" asked the major.

"Aluminum!" replied Barbicane.

"Aluminum?" cried his three colleagues in chorus.

"Unquestionably, my friends. This valuable 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, is very widely distributed, forming the base of most of the rocks, is three times lighter than iron, and seems to have been created for the express purpose of furnishing us with the material for our projectile."

"But, my dear president," said the major, "is not the cost price of aluminum extremely high?"

"It was so at its first discovery, but it has fallen now to nine dollars a pound."

"But still, nine dollars a pound!" replied the major, who was not willing readily to give in; "even that is an enormous price."

"Undoubtedly, my dear major; but not beyond our reach."

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

"Here is the result of my calculations," replied Barbicane. "A shot of 108 inches in diameter, and twelve inches in thickness, would weigh, in cast-iron, 67,440 pounds; cast in aluminum, its weight will be reduced to 19,250 pounds."

"Capital!" cried the major; "but do you know that, at nine dollars a pound, this projectile will cost—"

"One hundred and seventy-three thousand and fifty dollars ($173,050). I know it quite well. But fear not, my friends; the money will not be wanting for our enterprise. I will answer for it. Now what say you to aluminum, gentlemen?"

"Adopted!" replied the three members of the committee. So ended the first meeting. The question of the projectile was definitely settled.

VIII

History of the Cannon

The resolutions passed at the last meeting produced a great effect out of doors. Timid people took fright at the idea of a shot weighing 20,000 pounds being launched into space; they asked what cannon could ever transmit a sufficient velocity to such a mighty mass. The minutes of the second meeting were destined triumphantly to answer such questions. The following evening the discussion was renewed.

"My dear colleagues," said Barbicane, without further preamble, "the subject now before us is the construction of the engine, its length, its composition, and its weight. It is probable that we shall end by giving it gigantic dimensions; but however great may be the difficulties in the way, our mechanical genius will readily surmount them. Be good enough, then, to give me your attention, and do not hesitate to make objections at the close. I have no fear of them. The problem before us is how to communicate an initial force of 12,000 yards per second to a shell of 108 inches in diameter, weighing 20,000 pounds. Now when a projectile is launched into space, what happens to it? It is acted upon by three independent forces: the resistance of the air, the attraction of the earth, and the force of impulsion with which it is endowed. Let us examine these three forces. The resistance of the air is of little importance. The atmosphere of the earth does not exceed forty miles. Now, with the given rapidity, the projectile will have traversed this in five seconds, and the period is too brief for the resistance of the medium to be regarded otherwise than as insignificant. Proceding, then, to the attraction of the earth, that is, the weight of the shell, we know that this weight will diminish in the inverse ratio of the square of the distance. When a body left to itself falls to the surface of the earth, it falls five feet in the first second; and if the same body were removed 257,542 miles further

off, in other words, to the distance of the moon, its fall would be reduced to about half a line in the first second. That is almost equivalent to a state of perfect rest. Our business, then, is to overcome progressively this action of gravitation. The mode of accomplishing that is by the force of impulsion."

"There's the difficulty," broke in the major.

"True," replied the president; "but we will overcome that, for the force of impulsion will depend on the length of the engine and the powder employed, the latter being limited only by the resisting power of the former. Our business, then, to-day is with the dimensions of the cannon."

"Now, up to the present time," said Barbicane, "our longest guns have not exceeded twenty-five feet in length. We shall therefore astonish the world by the dimensions we shall be obliged to adopt. It must evidently be, then, a gun of great range, since the length of the piece will increase the detention of the gas accumulated behind the projectile; but there is no advantage in passing certain limits."

"Quite so," said the major. "What is the rule in such a case?"

"Ordinarily the length of a gun is twenty to twenty-five times the diameter of the shot, and its weight two hundred and thirty-five to two hundred and forty times that of the shot."

"That is not enough," cried J. T. Maston impetuously.

"I agree with you, my good friend; and, in fact, following this proportion for a projectile nine feet in diameter, weighing 30,000 pounds, the gun would only have a length of two hundred and twenty-five feet, and a weight of 7,200,000 pounds."

"Ridiculous!" rejoined Maston. "As well take a pistol."

"I think so too," replied Barbicane; "that is why I propose to quadruple that length, and to construct a gun of nine hundred feet."

The general and the major offered some objections; nevertheless, the proposition, actively supported by the secretary, was definitely adopted.

"But," said Elphinstone, "what thickness must we give it?"

"A thickness of six feet," replied Barbicane.

"You surely don't think of mounting a mass like that upon a carriage?" asked the major.

"It would be a superb idea, though," said Maston.

"But impracticable," replied Barbicane. "No, I think of sinking this engine in the earth alone, binding it with hoops of wrought iron, and finally surrounding it with a thick mass of masonry of stone and cement. The piece once cast, it must be bored with great precision, so as to preclude any possible windage. So there will be no loss whatever of gas, and all the expansive force of the powder will be employed in the propulsion."

"One simple question," said Elphinstone: "is our gun to be rifled?"

"No, certainly not," replied Barbicane; "we require an enormous initial velocity; and you are well aware that a shot quits a rifled gun less rapidly than it does a smooth-bore."

"True," rejoined the major.

The committee here adjourned for a few minutes to tea and sandwiches.

On the discussion being renewed, "Gentlemen," said Barbicane, "we must now take into consideration the metal to be employed. Our cannon must be possessed of great tenacity, great hardness, be infusible by heat, indissoluble, and inoxidable by the corrosive action of acids."

"There is no doubt about that," replied the major; "and as we shall have to employ an immense quantity of metal, we shall not be at a loss for choice."

"Well, then," said Morgan, "I propose the best alloy hitherto known, which consists of one hundred parts of copper, twelve of tin, and six of brass."

"I admit," replied the president, "that this composition has yielded excellent results, but in the present case it would be too expensive, and very difficult to work. I think, then, that we ought to adopt a material excellent in its way and of low price, such as cast iron. What is your advice, major?"

"I quite agree with you," replied Elphinstone.

"In fact," continued Barbicane, "cast iron costs ten times less than bronze; it is easy to cast, it runs readily from the moulds of sand, it is easy of manipulation, it is at once economical of money and of time. In addition, it is excellent as a material, and I well remember that during the war, at the siege of Atlanta, some iron guns fired one thousand rounds at intervals of twenty minutes without injury."

"Cast iron is very brittle, though," replied Morgan.

"Yes, but it possesses great resistance. I will now ask our worthy secretary to calculate the weight of a cast-iron gun with a bore of nine feet and a thickness of six feet of metal."

"In a moment," replied Maston. Then, dashing off some algebraical formulae with marvelous facility, in a minute or two he declared the following result:

"The cannon will weigh 68,040 tons. And, at two cents a pound, it will cost—"

"Two million five hundred and ten thousand seven hundred and one dollars."

Maston, the major, and the general regarded Barbicane with uneasy looks.

"Well, gentlemen," replied the president, "I repeat what I said yesterday. Make yourselves easy; the millions will not be wanting."

With this assurance of their president the committee separated, after having fixed their third meeting for the following evening.

IX

The Question of the Powders

There remained for consideration merely the question of powders. The public awaited with interest its final decision. The size of the projectile, the length of the cannon being settled, what would be the quantity of powder necessary to produce impulsion?

It is generally asserted that gunpowder was invented in the fourteenth century by the monk Schwartz, who paid for his grand discovery with his life. It is, however, pretty well proved that this story ought to be ranked among the legends of the middle ages. Gunpowder was not invented by any one; it was the lineal successor of the Greek fire, which, like itself, was composed of sulfur and saltpeter. Few persons are acquainted with the mechanical power of gunpowder. Now this is precisely what is necessary to be understood in order to comprehend the importance of the question submitted to the committee.

A litre of gunpowder weighs about two pounds; during combustion it produces 400 litres of gas. This gas, on being liberated and acted upon by temperature raised to 2,400 degrees, occupies a space of 4,000 litres: consequently the volume of powder is to the volume of gas produced by its combustion as 1 to 4,000. One may judge, therefore, of the tremendous pressure on this gas when compressed within a space 4,000 times too confined. All this was, of course, well known to the members of the committee when they met on the following evening.

The first speaker on this occasion was Major Elphinstone, who had been the director of the gunpowder factories during the war.

"Gentlemen," said this distinguished chemist, "I begin with some figures which will serve as the basis of our calculation. The old 24-pounder shot required for its discharge sixteen pounds of powder."

"You are certain of this amount?" broke in Barbicane.

"Quite certain," replied the major. "The Armstrong cannon employs only seventy-five pounds of powder for a projectile of eight hundred pounds, and the Rodman Columbiad uses only one hundred and sixty pounds of powder to send its half ton shot a distance of six miles. These facts cannot be called in question, for I myself raised the point during the depositions taken before the committee of artillery."

"Quite true," said the general.

"Well," replied the major, "these figures go to prove that the quantity of powder is not increased with the weight of the shot; that is to say, if a 24-pounder shot requires sixteen pounds of powder;—in other words, if in ordinary guns we employ a quantity of powder equal to two-thirds of the weight of the projectile, this proportion is not constant. Calculate, and you will see that in place of three hundred and thirty-three pounds of powder, the quantity is reduced to no more than one hundred and sixty pounds."

"What are you aiming at?" asked the president.

"If you push your theory to extremes, my dear major," said J. T. Maston, "you will get to this, that as soon as your shot becomes sufficiently heavy you will not require any powder at all."

"Our friend Maston is always at his jokes, even in serious matters," cried the major; "but let him make his mind easy, I am going presently to propose gunpowder enough to satisfy his artillerist's propensities. I only keep to statistical facts when I say that, during the war, and for the very largest guns, the weight of the powder was reduced, as the result of experience, to a tenth part of the weight of the shot."

"Perfectly correct," said Morgan; "but before deciding the quantity of powder necessary to give the impulse, I think it would be as well—"

"We shall have to employ a large-grained powder," continued the major; "its combustion is more rapid than that of the small."

"No doubt about that," replied Morgan; "but it is very destructive, and ends by enlarging the bore of the pieces."

"Granted; but that which is injurious to a gun destined to perform long service is not so to our Columbiad. We shall run no danger of an explosion; and it is necessary that our powder should take fire instantaneously in order that its mechanical effect may be complete."

"We must have," said Maston, "several touch-holes, so as to fire it at different points at the same time."

"Certainly," replied Elphinstone; "but that will render the working of the piece more difficult. I return then to my large-grained powder, which removes those difficulties. In his Columbiad charges Rodman employed a powder as large as chestnuts, made of willow charcoal, simply dried in cast-iron pans. This powder was hard and glittering, left no trace upon the hand, contained hydrogen and oxygen in large proportion, took fire instantaneously, and, though very destructive, did not sensibly injure the mouth-piece."

Up to this point Barbicane had kept aloof from the discussion; he left the others to speak while he himself listened; he had evidently got an idea. He now simply said, "Well, my friends, what quantity of powder do you propose?"

The three members looked at one another.

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

"Five hundred thousand," added the major.

"Eight hundred thousand," screamed Maston.

A moment of silence followed this triple proposal; it was at last broken by the president.

"Gentlemen," he quietly said, "I start from this principle, that the resistance of a gun, constructed under the given conditions, is unlimited. I shall surprise our friend Maston, then, by stigmatizing his calculations as timid; and I propose to double his 800,000 pounds of powder."

"Sixteen hundred thousand pounds?" shouted Maston, leaping from his seat.

"Just so."

"We shall have to come then to my ideal of a cannon half a mile long; for you see 1,600,000 pounds will occupy a space of about 20,000 cubic feet; and since the contents of your cannon do not exceed 54,000 cubic feet, it would be half full; and the bore will not be more than long enough for the gas to communicate to the projectile sufficient impulse."

"Nevertheless," said the president, "I hold to that quantity of powder. Now, 1,600,000 pounds of powder will create 6,000,000,000 litres of gas. Six thousand millions! You quite understand?"

"What is to be done then?" said the general.

"The thing is very simple; we must reduce this enormous quantity of powder, while preserving to it its mechanical power."

"Good; but by what means?"

"I am going to tell you," replied Barbicane quietly.

"Nothing is more easy than to reduce this mass to one quarter of its bulk. You know that curious cellular matter which constitutes the elementary tissues of vegetable? This substance is found quite pure in many bodies, especially in cotton, which is nothing more than the down of the seeds of the cotton plant. Now cotton, combined with cold nitric acid, become transformed into a substance eminently insoluble, combustible, and explosive. It was first discovered in 1832, by Braconnot, a French chemist, who called it xyloidine. In 1838 another Frenchman, Pelouze, investigated its different properties, and finally, in 1846, Schonbein, professor of chemistry at Bale, proposed its employment for purposes of war. This powder, now called pyroxyle, or fulminating cotton, is prepared with great facility by simply plunging cotton for fifteen minutes in nitric acid, then washing it in water, then drying it, and it is ready for use."

"Nothing could be more simple," said Morgan.

"Moreover, pyroxyle is unaltered by moisture—a valuable property to us, inasmuch as it would take several days to charge the cannon. It ignites at 170

degrees in place of 240, and its combustion is so rapid that one may set light to it on the top of the ordinary powder, without the latter having time to ignite."

"Perfect!" exclaimed the major.

"Only it is more expensive."

"What matter?" cried J. T. Maston.

"Finally, it imparts to projectiles a velocity four times superior to that of gunpowder. I will even add, that if we mix it with one-eighth of its own weight of nitrate of potassium, its expansive force is again considerably augmented."

"Will that be necessary?" asked the major.

"I think not," replied Barbicane. "So, then, in place of 1,600,000 pounds of powder, we shall have but 400,000 pounds of fulminating cotton; and since we can, without danger, compress 500 pounds of cotton into twenty-seven cubic feet, the whole quantity will not occupy a height of more than 180 feet within the bore of the Columbiad. In this way the shot will have more than 700 feet of bore to traverse under a force of 6,000,000,000 litres of gas before taking its flight toward the moon."

At this juncture J. T. Maston could not repress his emotion; he flung himself into the arms of his friend with the violence of a projectile, and Barbicane would have been stove in if he had not been boom-proof.

This incident terminated the third meeting of the committee.

Barbicane and his bold colleagues, to whom nothing seemed impossible, had succeeding in solving the complex problems of projectile, cannon, and powder. Their plan was drawn up, and it only remained to put it into execution.

"A mere matter of detail, a bagatelle," said J. T. Maston.

X

One Enemy v. Twenty-Five Millions of Friends

The American public took a lively interest in the smallest details of the enterprise of the Gun Club. It followed day by day the discussion of the committee. The most simple preparations for the great experiment, the questions of figures which it involved, the mechanical difficulties to be resolved—in one word, the entire plan of work—roused the popular excitement to the highest pitch.

The purely scientific attraction was suddenly intensified by the following incident:

We have seen what legions of admirers and friends Barbicane's project had rallied round its author. There was, however, one single individual alone in all the States of the Union who protested against the attempt of the Gun Club. He attacked it furiously on every opportunity, and human nature is such that Barbicane felt more keenly the opposition of that one man than he did the applause of all the others. He was well aware of the motive of this antipathy, the origin of this solitary enmity, the cause of its personality and old standing, and in what rivalry of self-love it had its rise.

This persevering enemy the president of the Gun Club had never seen. Fortunate that it was so, for a meeting between the two men would certainly have been attended with serious consequences. This rival was a man of science, like Barbicane himself, of a fiery, daring, and violent disposition; a pure Yankee. His name was Captain Nicholl; he lived at Philadelphia.

Most people are aware of the curious struggle which arose during the Federal war between the guns and armor of iron-plated ships. The result was the entire reconstruction of the navy of both the continents; as the one grew heavier, the other became thicker in proportion. The Merrimac, the Monitor, the Tennessee, the Weehawken discharged enormous projectiles themselves, after having been armor-clad against the projectiles of others. In fact they did to others that which they would not they should do to them—that grand principle of immortality upon which rests the whole art of war.

Now if Barbicane was a great founder of shot, Nicholl was a great forger of plates; the one cast night and day at Baltimore, the other forged day and night at Philadelphia. As soon as ever Barbicane invented a new shot, Nicholl invented a new plate; each followed a current of ideas essentially opposed to the other. Happily for these citizens, so useful to their country, a distance of from fifty to sixty miles separated them from one another, and they had never yet met. Which of these two inventors had the advantage over the other it was difficult to decide from the results obtained. By last accounts, however, it would seem that the armor-plate would in the end have to give way to the shot; nevertheless, there were competent judges who had their doubts on the point.

At the last experiment the cylindro-conical projectiles of Barbicane stuck like so many pins in the Nicholl plates. On that day the Philadelphia iron-forger then believed himself victorious, and could not evince contempt enough for his rival; but when the other afterward substituted

for conical shot simple 600-pound shells, at very moderate velocity, the captain was obliged to give in. In fact, these projectiles knocked his best metal plate to shivers.

Matters were at this stage, and victory seemed to rest with the shot, when the war came to an end on the very day when Nicholl had completed a new armor-plate of wrought steel. It was a masterpiece of its kind, and bid defiance to all the projectiles of the world. The captain had it conveyed to the Polygon at Washington, challenging the president of the Gun Club to break it. Barbicane, peace having been declared, declined to try the experiment.

Nicholl, now furious, offered to expose his plate to the shock of any shot, solid, hollow, round, or conical. Refused by the president, who did not choose to compromise his last success.

Nicholl, disgusted by this obstinacy, tried to tempt Barbicane by offering him every chance. He proposed to fix the plate within two hundred yards of the gun. Barbicane still obstinate in refusal. A hundred yards? Not even seventy-five!

"At fifty then!" roared the captain through the newspapers. "At twenty-five yards! and I'll stand behind!"

Barbicane returned for answer that, even if Captain Nicholl would be so good as to stand in front, he would not fire any more.

Nicholl could not contain himself at this reply; threw out hints of cowardice; that a man who refused to fire a cannon-shot was pretty near being afraid of it; that artillerists who fight at six miles distance are substituting mathematical formulae for individual courage.

To these insinuations Barbicane returned no answer; perhaps he never heard of them, so absorbed was he in the calculations for his great enterprise.

When his famous communication was made to the Gun Club, the captain's wrath passed all bounds; with his intense jealousy was mingled a feeling of absolute impotence. How was he to invent anything to beat this 900-feet Columbiad? What armor-plate could ever resist a projectile of 30,000 pounds weight? Overwhelmed at first under this violent shock, he by and by recovered himself, and resolved to crush the proposal by weight of his arguments.

He then violently attacked the labors of the Gun Club, published a number of letters in the newspapers, endeavored to prove Barbicane ignorant of the first principles of gunnery. He maintained that it was absolutely impossible to impress upon any body whatever a velocity of 12,000 yards per second; that even with such a velocity a projectile of such a weight could not transcend the limits of the earth's atmosphere.

Further still, even regarding the velocity to be acquired, and granting it to be sufficient, the shell could not resist the pressure of the gas developed by the ignition of 1,600,000 pounds of powder; and supposing it to resist that pressure, it would be less able to support that temperature; it would melt on quitting the Columbiad, and fall back in a red-hot shower upon the heads of the imprudent spectators.

Barbicane continued his work without regarding these attacks.

Nicholl then took up the question in its other aspects. Without touching upon its uselessness in all points of view, he regarded the experiment as fraught with extreme danger, both to the citizens, who might sanction by their presence so reprehensible a spectacle, and also to the towns in the neighborhood of this deplorable cannon. He also observed that if the projectile did not succeed in reaching its destination (a result absolutely impossible), it must inevitably fall back upon the earth, and that the shock of such a mass, multiplied by the square of its velocity, would seriously endanger every point of the globe. Under the circumstances, therefore, and without interfering with the rights of free citizens, it was a case for the intervention of Government, which ought not to endanger the safety of all for the pleasure of one individual.

In spite of all his arguments, however, Captain Nicholl remained alone in his opinion. Nobody listened to him, and he did not succeed in alienating a single admirer from the president of the Gun Club. The latter did not even take the pains to refute the arguments of his rival.

Nicholl, driven into his last entrenchments, and not able to fight personally in the cause, resolved to fight with money. He published, therefore, in the Richmond Inquirer a series of wagers, conceived in these terms, and on an increasing scale:

No. 1 ($1,000):—That the necessary funds for the experiment of the Gun Club will not be forthcoming.

No. 2 ($2,000):—That the operation of casting a cannon of 900 feet is impracticable, and cannot possibly succeed.

No. 3 ($3,000):—That is it impossible to load the Columbiad, and that the pyroxyle will take fire spontaneously under the pressure of the projectile.

No. 4 ($4,000):—That the Columbiad will burst at the first fire.

No. 5 ($5,000):—That the shot will not travel farther than six miles, and that it will fall back again a few seconds after its discharge.

It was an important sum, therefore, which the captain risked in his invincible obstinacy. He had no less than $15,000 at stake.

Notwithstanding the importance of the challenge, on the 19th of May he received a sealed packet containing the following superbly laconic reply:

"BALTIMORE, *October 19.*
"*Done.*
"BARBICANE."

XI

Florida and Texas

One question remained yet to be decided; it was necessary to choose a favorable spot for the experiment. According to the advice of the Observatory of Cambridge, the gun must be fired perpendicularly to the plane of the horizon, that is to say, toward the zenith. Now the moon does not traverse the zenith, except in places situated between 0@ and 28@ of latitude. It became, then, necessary to determine exactly that spot on the globe where the immense Columbiad should be cast.

On the 20th of October, at a general meeting of the Gun Club, Barbicane produced a magnificent map of the United States. "Gentlemen," said he, in opening the discussion, "I presume that we are all agreed that this experiment cannot and ought not to be tried anywhere but within the limits of the soil of the Union. Now, by good fortune, certain frontiers of the United States extend downward as far as the 28th parallel of the north latitude. If you will cast your eye over this map, you will see that we have at our disposal the whole of the southern portion of Texas and Florida."

It was finally agreed, then, that the Columbiad must be cast on the soil of either Texas or Florida. The result, however, of this decision was to create a rivalry entirely without precedent between the different towns of these two States.

The 28th parallel, on reaching the American coast, traverses the peninsula of Florida, dividing it into two nearly equal portions. Then, plunging into the Gulf of Mexico, it subtends the arc formed by the coast of Alabama, Mississippi, and Louisiana; then skirting Texas, off which it cuts an angle, it continues its course over Mexico, crosses the Sonora, Old California, and loses itself in the Pacific Ocean. It was, therefore, only those portions of Texas and Florida which were situated below this parallel which came within the prescribed conditions of latitude.

Florida, in its southern part, reckons no cities of importance; it is simply studded with forts raised against the roving Indians. One solitary town, Tampa Town, was able to put in a claim in favor of its situation.

In Texas, on the contrary, the towns are much more numerous and important. Corpus Christi, in the county of Nueces, and all the cities situated on the Rio Bravo, Laredo, Comalites, San Ignacio on the Web, Rio Grande City on the Starr, Edinburgh in the Hidalgo, Santa Rita, Elpanda, Brownsville in the Cameron, formed an imposing league against the pretensions of Florida. So, scarcely was the decision known, when the Texan and Floridan deputies arrived at Baltimore in an incredibly short space of time. From that very moment President Barbicane and the influential members of the Gun Club were besieged day and night by formidable claims. If seven cities of Greece contended for the honor of having given birth to a Homer, here were two entire States threatening to come to blows about the question of a cannon.

The rival parties promenaded the streets with arms in their hands; and at every occasion of their meeting a collision was to be apprehended which might have been attended with disastrous results. Happily the prudence and address of President Barbicane averted the danger. These personal demonstrations found a division in the newspapers of the different States. The New York Herald and the Tribune supported Texas, while the Times and the American Review espoused the cause of the Floridan deputies. The members of the Gun Club could not decide to which to give the preference.

Texas produced its array of twenty-six counties; Florida replied that twelve counties were better than twenty-six in a country only one-sixth part of the size.

Texas plumed itself upon its 330,000 natives; Florida, with a far smaller territory, boasted of being much more densely populated with 56,000.

The Texans, through the columns of the Herald claimed that some regard should be had to a State which grew the best cotton in all America, produced the best green oak for the service of the navy, and contained the finest oil, besides iron mines, in which the yield was fifty per cent. of pure metal.

To this the American Review replied that the soil of Florida, although not equally rich, afforded the best conditions for the moulding and casting of the Columbiad, consisting as it did of sand and argillaceous earth.

"That may be all very well," replied the Texans; "but you must first get to this country. Now the communications with Florida are difficult, while the coast of Texas offers the bay of Galveston, which possesses a circumference of fourteen leagues, and is capable of containing the navies of the entire world!"

"A pretty notion truly," replied the papers in the interest of Florida, "that of Galveston bay below the 29th parallel! Have we not got the bay of Espiritu Santo, opening precisely upon the 28th degree, and by which ships can reach Tampa Town by direct route?"

"A fine bay; half choked with sand!"

"Choked yourselves!" returned the others.

Thus the war went on for several days, when Florida endeavored to draw her adversary away on to fresh ground; and one morning the Times hinted that, the enterprise being essentially American, it ought not to be attempted upon other than purely American territory.

To these words Texas retorted, "American! are we not as much so as you? Were not Texas and Florida both incorporated into the Union in 1845?"

"Undoubtedly," replied the Times; "but we have belonged to the Americans ever since 1820."

"Yes!" returned the Tribune; "after having been Spaniards or English for two hundred years, you were sold to the United States for five million dollars!"

"Well! and why need we blush for that? Was not Louisiana bought from Napoleon in 1803 at the price of sixteen million dollars?"

"Scandalous!" roared the Texas deputies. "A wretched little strip of country like Florida to dare to compare itself to Texas, who, in place of selling herself, asserted her own independence, drove out the Mexicans in March 2, 1846, and declared herself a federal republic after the victory gained by Samuel Houston, on the banks of the San Jacinto, over the troops of Santa Anna!—a country, in fine, which voluntarily annexed itself to the United States of America!"

"Yes; because it was afraid of the Mexicans!" replied Florida.

"Afraid!" From this moment the state of things became intolerable. A sanguinary encounter seemed daily imminent between the two parties in the streets of Baltimore. It became necessary to keep an eye upon the deputies.

President Barbicane knew not which way to look. Notes, documents, letters full of menaces showered down upon his house. Which side ought he to take? As regarded the appropriation of the soil, the facility of communication, the rapidity of transport, the claims of both States were evenly balanced. As for political prepossessions, they had nothing to do with the question.

This dead block had existed for some little time, when Barbicane resolved to get rid of it all at once. He called a meeting of his colleagues, and laid before them a proposition which, it will be seen, was profoundly sagacious.

"On carefully considering," he said, "what is going on now between Florida and Texas, it is clear that the same difficulties will recur with

all the towns of the favored State. The rivalry will descend from State to city, and so on downward. Now Texas possesses eleven towns within the prescribed conditions, which will further dispute the honor and create us new enemies, while Florida has only one. I go in, therefore, for Florida and Tampa Town."

This decision, on being made known, utterly crushed the Texan deputies. Seized with an indescribable fury, they addressed threatening letters to the different members of the Gun Club by name. The magistrates had but one course to take, and they took it. They chartered a special train, forced the Texans into it whether they would or no; and they quitted the city with a speed of thirty miles an hour.

Quickly, however, as they were despatched, they found time to hurl one last and bitter sarcasm at their adversaries.

Alluding to the extent of Florida, a mere peninsula confined between two seas, they pretended that it could never sustain the shock of the discharge, and that it would "bust up" at the very first shot.

"Very well, let it bust up!" replied the Floridans, with a brevity of the days of ancient Sparta.

XII

Urbi Et Orbi

The astronomical, mechanical, and topographical difficulties resolved, finally came the question of finance. The sum required was far too great for any individual, or even any single State, to provide the requisite millions.

President Barbicane undertook, despite of the matter being a purely American affair, to render it one of universal interest, and to request the financial co-operation of all peoples. It was, he maintained, the right and duty of the whole earth to interfere in the affairs of its satellite. The subscription opened at Baltimore extended properly to the whole world—Urbi et orbi.

This subscription was successful beyond all expectation; notwithstanding that it was a question not of lending but of giving the money. It was a purely disinterested operation in the strictest sense of the term, and offered not the slightest chance of profit.