

CHAPTER V.

THE COLDS OF SPACE.

How could they imagine that the Observatory men had committed such a blunder? Barbican would not believe it possible. He made the Captain go over his calculation again and again; but no flaw was to be found in it. He himself carefully examined it, figure after figure, but he could find nothing wrong. They both took up the formula and subjected it to the strongest tests; but it was invulnerable. There was no denying the fact. The Cambridge professors had undoubtedly blundered in saying that an initial velocity of 12,000 yards a second would be enough to carry them to the neutral point. A velocity of nearly 18,000 yards would be the very lowest required for such a purpose. They had simply forgotten to allow a third for friction.

The three friends kept profound silence for some time. Breakfast now was the last thing thought of. Barbican, with teeth grating, fingers clutching, and eye-brows closely contracting, gazed grimly through the window. The Captain, as a last resource, once more examined his calculations, earnestly hoping to find a figure wrong. Ardan could neither sit, stand nor lie still for a second, though he tried all three. His silence, of course, did not last long.

"Ha! ha! ha!" he laughed bitterly. "Precious scientific men! Villainous old hombogues! The whole set not worth a straw! I hope to gracious,

since we must fall, that we shall drop down plumb on Cambridge Observatory, and not leave a single one of the miserable old women, called professors, alive in the premises!"

A certain expression in Ardan's angry exclamation had struck the Captain like a shot, and set his temples throbbing violently.

"Must fall!" he exclaimed, starting up suddenly. "Let us see about that! It is now seven o'clock in the morning. We must have, therefore, been at least thirty-two hours on the road, and more than half of our passage is already made. If we are going to fall at all, we must be falling now! I'm certain we're not, but, Barbican, you have to find it out!"

Barbican caught the idea like lightning, and, seizing a compass, he began through the floor window to measure the visual angle of the distant Earth. The apparent immobility of the Projectile allowed him to do this with great exactness. Then laying aside the instrument, and wiping off the thick drops of sweat that bedewed his forehead, he began jotting down some figures on a piece of paper. The Captain looked on with keen interest; he knew very well that Barbican was calculating their distance from the Earth by the apparent measure of the terrestrial diameter, and he eyed him anxiously.

Pretty soon his friends saw a color stealing into Barbican's pale face, and a triumphant light glittering in his eye.

"No, my brave boys!" he exclaimed at last throwing down his pencil,
"we're not falling! Far from it, we are at present more than 150
thousand miles from the Earth!"

"Hurrah!" }

"Bravo!" } cried M'Nicholl and Ardan, in a breath.

"We have passed the point where we should have stopped if we had had no
more initial velocity than the Cambridge men allowed us!"

"Hurrah! hurrah!"

"Bravo, Bravissimo!"

"And we're still going up!"

"Glory, glory, hallelujah!" sang M'Nicholl, in the highest excitement.

"Vive ce cher Barbican!" cried Ardan, bursting into French as usual
whenever his feelings had the better of him.

"Of course we're marching on!" continued M'Nicholl, "and I know the
reason why, too. Those 400,000 pounds of gun-cotton gave us greater
initial velocity than we had expected!"

"You're right, Captain!" added Barbican; "besides, you must not forget
that, by getting rid of the water, the Projectile was relieved of

considerable weight!"

"Correct again!" cried the Captain. "I had not thought of that!"

"Therefore, my brave boys," continued Barbican, with some excitement;
"away with melancholy! We're all right!"

"Yes; everything is lovely and the goose hangs high!" cried the Captain,
who on grand occasions was not above a little slang.

"Talking of goose reminds me of breakfast," cried Ardan; "I assure you,
my fright has not taken away my appetite!"

"Yes," continued Barbican. "Captain, you're quite right. Our initial
velocity very fortunately was much greater than what our Cambridge
friends had calculated for us!"

"Hang our Cambridge friends and their calculations!" cried Ardan, with
some asperity; "as usual with your scientific men they've more brass
than brains! If we're not now bed-fellows with the oysters in the Gulf
of Mexico, no thanks to our kind Cambridge friends. But talking of
oysters, let me remind you again that breakfast is ready."

The meal was a most joyous one. They ate much, they talked more, but
they laughed most. The little incident of Algebra had certainly very
much enlivened the situation.

"Now, my boys," Ardan went on, "all things thus turning out quite comfortable, I would just ask you why we should not succeed? We are fairly started. No breakers ahead that I can see. No rock on our road. It is freer than the ships on the raging ocean, aye, freer than the balloons in the blustering air. But the ship arrives at her destination; the balloon, borne on the wings of the wind, rises to as high an altitude as can be endured; why then should not our Projectile reach the Moon?"

"It will reach the Moon!" nodded Barbican.

"We shall reach the Moon or know for what!" cried M'Nicholl, enthusiastically.

"The great American nation must not be disappointed!" continued Ardan.

"They are the only people on Earth capable of originating such an enterprise! They are the only people capable of producing a Barbican!"

"Hurrah!" cried M'Nicholl.

"That point settled," continued the Frenchman, "another question comes up to which I have not yet called your attention. When we get to the Moon, what shall we do there? How are we going to amuse ourselves? I'm afraid our life there will be awfully slow!"

His companions emphatically disclaimed the possibility of such a thing.

"You may deny it, but I know better, and knowing better, I have laid in my stores accordingly. You have but to choose. I possess a varied assortment. Chess, draughts, cards, dominoes--everything in fact, but a billiard table?"

"What!" exclaimed Barbican; "cumbered yourself with such gimcracks?"

"Such gimcracks are not only good to amuse ourselves with, but are eminently calculated also to win us the friendship of the Selenites."

"Friend Michael," said Barbican, "if the Moon is inhabited at all, her inhabitants must have appeared several thousand years before the advent of Man on our Earth, for there seems to be very little doubt that Luna is considerably older than Terra in her present state. Therefore, Selenites, if their brain is organized like our own, must have by this time invented all that we are possessed of, and even much which we are still to invent in the course of ages. The probability is that, instead of their learning from us, we shall have much to learn from them."

"What!" asked Ardan, "you think they have artists like Phidias, Michael Angelo and Raphael?"

"Certainly."

"And poets like Homer, Virgil, Dante, Shakspeare, Göthe and Hugo?"

"Not a doubt of it."

"And philosophers like Plato, Aristotle, Descartes, Bacon, Kant?"

"Why not?"

"And scientists like Euclid, Archimedes, Copernicus, Newton, Pascal?"

"I should think so."

"And famous actors, and singers, and composers, and--and photographers?"

"I could almost swear to it."

"Then, dear boy, since they have gone ahead as far as we and even farther, why have not those great Selenites tried to start a communication with the Earth? Why have they not fired a projectile from the regions lunar to the regions terrestrial?"

"Who says they have not done so?" asked Barbican, coolly.

"Attempting such a communication," observed the Captain, "would certainly be much easier for them than for us, principally for two reasons. First, attraction on the Moon's surface being six times less than on the Earth's, a projectile could be sent off more rapidly; second, because, as this projectile need be sent only 24 instead of 240 thousand miles, they could do it with a quantity of powder ten times less than what we should require for the same purpose."

"Then I ask again," said the Frenchman; "why haven't they made such an attempt?"

"And I reply again," answered Barbican. "How do you know that they have not made such an attempt?"

"Made it? When?"

"Thousands of years ago, before the invention of writing, before even the appearance of Man on the Earth."

"But the bullet?" asked Ardan, triumphantly; "Where's the bullet? Produce the bullet!"

"Friend Michael," answered Barbican, with a quiet smile, "you appear to forget that the 5/6 of the surface of our Earth is water. 5 to 1, therefore, that the bullet is more likely to be lying this moment at the bottom of the Atlantic or the Pacific than anywhere else on the surface of our globe. Besides, it may have sunk into some weak point of the surface, at the early epoch when the crust of the Earth had not acquired sufficient solidity."

"Captain," said Ardan, turning with a smile to M'Nicholl; "no use in trying to catch Barby; slippery as an eel, he has an answer for everything. Still I have a theory on the subject myself, which I think it no harm to ventilate. It is this: The Selenites have never sent us

any projectile at all, simply because they had no gunpowder: being older and wiser than we, they were never such fools as to invent any.--But, what's that? Diana howling for her breakfast! Good! Like genuine scientific men, while squabbling over nonsense, we let the poor animals die of hunger. Excuse us, Diana; it is not the first time the little suffer from the senseless disputes of the great."

So saying he laid before the animal a very toothsome pie, and contemplated with evident pleasure her very successful efforts towards its hasty and complete disappearance.

"Looking at Diana," he went on, "makes me almost wish we had made a Noah's Ark of our Projectile by introducing into it a pair of all the domestic animals!"

"Not room enough," observed Barbican.

"No doubt," remarked the Captain, "the ox, the cow, the horse, the goat, all the ruminating animals would be very useful in the Lunar continent. But we couldn't turn our Projectile into a stable, you know."

"Still, we might have made room for a pair of poor little donkeys!" observed Ardan; "how I love the poor beasts. Fellow feeling, you will say. No doubt, but there really is no animal I pity more. They are the most ill-treated brutes in all creation. They are not only banged during life; they are banged worse after death!"

"Hey! How do you make that out?" asked his companions, surprised.

"Because we make their skins into drum heads!" replied Ardan, with an air, as if answering a conundrum.

Barbican and M'Nicholl could hardly help laughing at the absurd reply of their lively companion, but their hilarity was soon stopped by the expression his face assumed as he bent over Satellite's body, where it lay stretched on the sofa.

"What's the matter now?" asked Barbican.

"Satellite's attack is over," replied Ardan.

"Good!" said M'Nicholl, misunderstanding him.

"Yes, I suppose it is good for the poor fellow," observed Ardan, in melancholy accents. "Life with one's skull broken is hardly an enviable possession. Our grand acclimatization project is knocked sky high, in more senses than one!"

There was no doubt of the poor dog's death. The expression of Ardan's countenance, as he looked at his friends, was of a very rueful order.

"Well," said the practical Barbican, "there's no help for that now; the next thing to be done is to get rid of the body. We can't keep it here with us forty-eight hours longer."

"Of course not," replied the Captain, "nor need we; our lights, being provided with hinges, can be lifted back. What is to prevent us from opening one of them, and flinging the body out through it!"

The President of the Gun Club reflected a few minutes; then he spoke:

"Yes, it can be done; but we must take the most careful precautions."

"Why so?" asked Ardan.

"For two simple reasons;" replied Barbican; "the first refers to the air enclosed in the Projectile, and of which we must be very careful to lose only the least possible quantity."

"But as we manufacture air ourselves!" objected Ardan.

"We manufacture air only partly, friend Michael," replied Barbican. "We manufacture only oxygen; we can't supply nitrogen--By the bye, Ardan, won't you watch the apparatus carefully every now and then to see that the oxygen is not generated too freely. Very serious consequences would attend an immoderate supply of oxygen--No, we can't manufacture nitrogen, which is so absolutely necessary for our air and which might escape readily through the open windows."

"What! the few seconds we should require for flinging out poor Satellite?"

"A very few seconds indeed they should be," said Barbican, very gravely.

"Your second reason?" asked Ardan.

"The second reason is, that we must not allow the external cold, which must be exceedingly great, to penetrate into our Projectile and freeze us alive."

"But the Sun, you know--"

"Yes, the Sun heats our Projectile, but it does not heat the vacuum through which we are now floating. Where there is no air there can neither be heat nor light; just as wherever the rays of the Sun do not arrive directly, it must be both cold and dark. The temperature around us, if there be anything that can be called temperature, is produced solely by stellar radiation. I need not say how low that is in the scale, or that it would be the temperature to which our Earth should fall, if the Sun were suddenly extinguished."

"Little fear of that for a few more million years," said M'Nicholl.

"Who can tell?" asked Ardan. "Besides, even admitting that the Sun will not soon be extinguished, what is to prevent the Earth from shooting away from him?"

"Let friend Michael speak," said Barbican, with a smile, to the Captain;

"we may learn something."

"Certainly you may," continued the Frenchman, "if you have room for anything new. Were we not struck by a comet's tail in 1861?"

"So it was said, anyhow," observed the Captain. "I well remember what nonsense there was in the papers about the 'phosphorescent auroral glare.'"

"Well," continued the Frenchman, "suppose the comet of 1861 influenced the Earth by an attraction superior to the Sun's. What would be the consequence? Would not the Earth follow the attracting body, become its satellite, and thus at last be dragged off to such a distance that the Sun's rays could no longer excite heat on her surface?"

"Well, that might possibly occur," said Barbican slowly, "but even then I question if the consequences would be so terrible as you seem to apprehend."

"Why not?"

"Because the cold and the heat might still manage to be nearly equalized on our globe. It has been calculated that, had the Earth been carried off by the comet of '61, when arrived at her greatest distance, she would have experienced a temperature hardly sixteen times greater than the heat we receive from the Moon, which, as everybody knows, produces no appreciable effect, even when concentrated to a focus by the most

powerful lenses."

"Well then," exclaimed Ardan, "at such a temperature--"

"Wait a moment," replied Barbican. "Have you never heard of the principle of compensation? Listen to another calculation. Had the Earth been dragged along with the comet, it has been calculated that at her perihelion, or nearest point to the Sun, she would have to endure a heat 28,000 times greater than our mean summer temperature. But this heat, fully capable of turning the rocks into glass and the oceans into vapor, before proceeding to such extremity, must have first formed a thick interposing ring of clouds, and thus considerably modified the excessive temperature. Therefore, between the extreme cold of the aphelion and the excessive heat of the perihelion, by the great law of compensation, it is probable that the mean temperature would be tolerably endurable."

"At how many degrees is the temperature of the interplanetary space estimated?" asked M'Nicholl.

"Some time ago," replied Barbican, "this temperature was considered to be very low indeed--millions and millions of degrees below zero. But Fourier of Auxerre, a distinguished member of the Académie des Sciences, whose Mémoires on the temperature of the Planetary spaces appeared about 1827, reduced these figures to considerably diminished proportions. According to his careful estimation, the temperature of space is not much lower than 70 or 80 degrees Fahr. below zero."

"No more?" asked Ardan.

"No more," answered Barbican, "though I must acknowledge we have only his word for it, as the *Mémoire* in which he had recorded all the elements of that important determination, has been lost somewhere, and is no longer to be found."

"I don't attach the slightest importance to his, or to any man's words, unless they are sustained by reliable evidence," exclaimed M'Nicholl.

"Besides, if I'm not very much mistaken, Pouillet--another countryman of yours, Ardan, and an Academician as well as Fourier--esteems the temperature of interplanetary spaces to be at least 256° Fahr. below zero. This we can easily verify for ourselves this moment by actual experiment."

"Not just now exactly," observed Barbican, "for the solar rays, striking our Projectile directly, would give us a very elevated instead of a very low temperature. But once arrived at the Moon, during those nights fifteen days long, which each of her faces experiences alternately, we shall have plenty of time to make an experiment with every condition in our favor. To be sure, our Satellite is at present moving in a vacuum."

"A vacuum?" asked Ardan; "a perfect vacuum?"

"Well, a perfect vacuum as far as air is concerned."

"But is the air replaced by nothing?"

"Oh yes," replied Barbican. "By ether."

"Ah, ether! and what, pray, is ether?"

"Ether, friend Michael, is an elastic gas consisting of imponderable atoms, which, as we are told by works on molecular physics, are, in proportion to their size, as far apart as the celestial bodies are from each other in space. This distance is less than the $1/3000000 \times 1/1000'$, or the one trillionth of a foot. The vibrations of the molecules of this ether produce the sensations of light and heat, by making 430 trillions of undulations per second, each undulation being hardly more than the one ten-millionth of an inch in width."

"Trillions per second! ten-millionths of an inch in width!" cried Ardan.

"These oscillations have been very neatly counted and ticketed, and checked off! Ah, friend Barbican," continued the Frenchman, shaking his head, "these numbers are just tremendous guesses, frightening the ear but revealing nothing to the intelligence."

"To get ideas, however, we must calculate--"

"No, no!" interrupted Ardan: "not calculate, but compare. A trillion tells you nothing--Comparison, everything. For instance, you say, the volume of Uranus is 76 times greater than the Earth's; Saturn's 900 times greater; Jupiter's 1300 times greater; the Sun's 1300 thousand

times greater--You may tell me all that till I'm tired hearing it, and I shall still be almost as ignorant as ever. For my part I prefer to be told one of those simple comparisons that I find in the old almanacs: The Sun is a globe two feet in diameter; Jupiter, a good sized orange; Saturn, a smaller orange; Neptune, a plum; Uranus, a good sized cherry; the Earth, a pea; Venus, also a pea but somewhat smaller; Mars, a large pin's head; Mercury, a mustard seed; Juno, Ceres, Vesta, Pallas, and the other asteroids so many grains of sand. Be told something like that, and you have got at least the tail of an idea!"

This learned burst of Ardan's had the natural effect of making his hearers forget what they had been arguing about, and they therefore proceeded at once to dispose of Satellite's body. It was a simple matter enough--no more than to fling it out of the Projectile into space, just as the sailors get rid of a dead body by throwing it into the sea. Only in this operation they had to act, as Barbican recommended, with the utmost care and dispatch, so as to lose as little as possible of the internal air, which, by its great elasticity, would violently strive to escape. The bolts of the floor-light, which was more than a foot in diameter, were carefully unscrewed, while Ardan, a good deal affected, prepared to launch his dog's body into space. The glass, worked by a powerful lever which enabled it to overcome the pressure of the enclosed air, turned quickly on its hinges, and poor Satellite was dropped out. The whole operation was so well managed that very little air escaped, and ever afterwards Barbican employed the same means to rid the Projectile of all the litter and other useless matter by which it was

occasionally encumbered.

The evening of this third of December wore away without further incident. As soon as Barbican had announced that the Projectile was still winging its way, though with retarded velocity, towards the lunar disc, the travellers quietly retired to rest.