

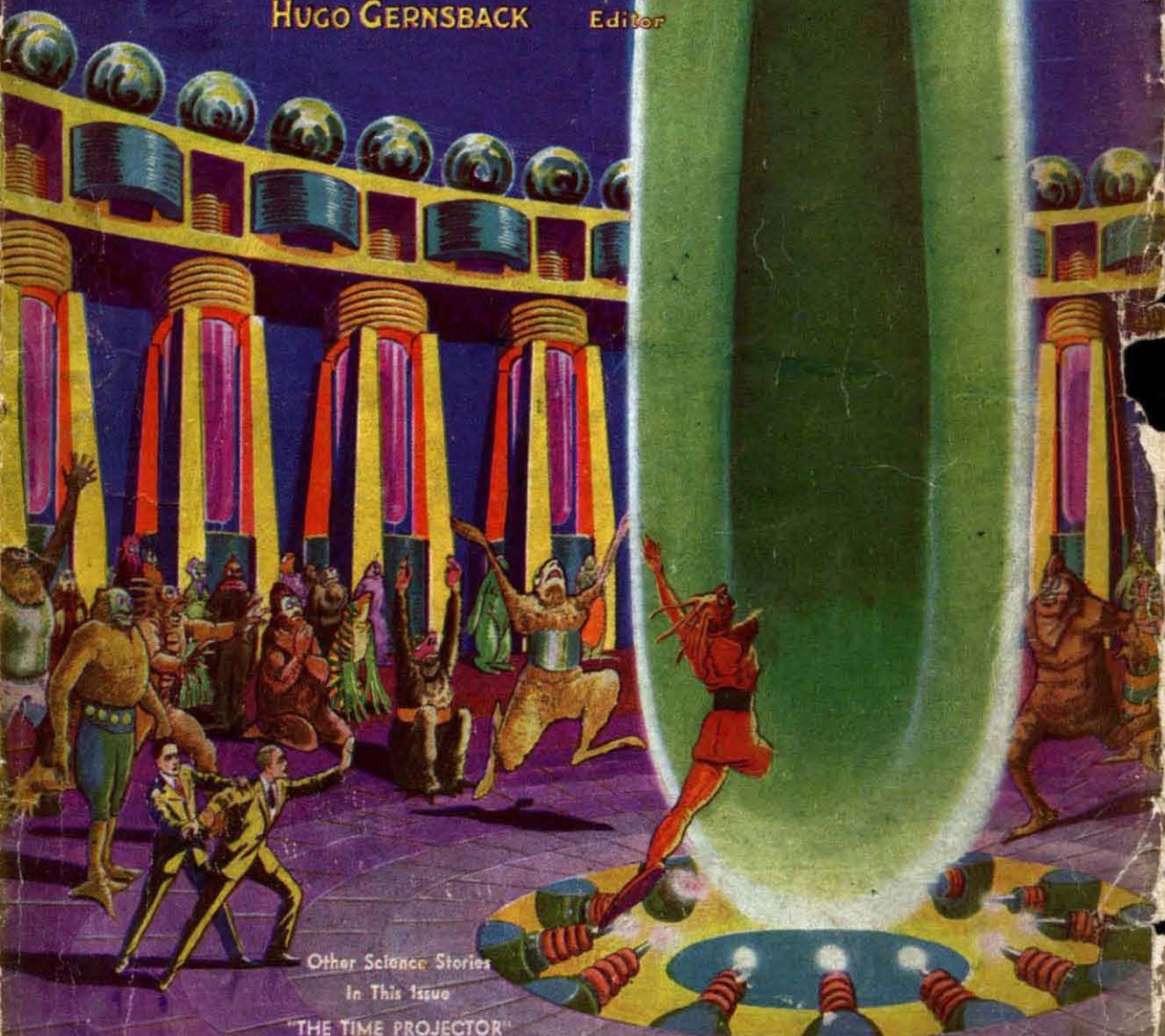
ADVENTURES OF FUTURE SCIENCE

Wonder Stories

July



HUGO GERNSBACK Editor



Other Science Stories
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"THE TIME PROJECTOR"

By David Lesser and Dr. D. H. Koller

"THE PLANET OF DESPAIR"

By R. F. Stenzel

"THE CITY OF SINGING FLAME"

By Clark Ashton Smith





Wonder Stories

THE MAGAZINE
OF PROPHETIC FICTION

Vol. 3, No. 2

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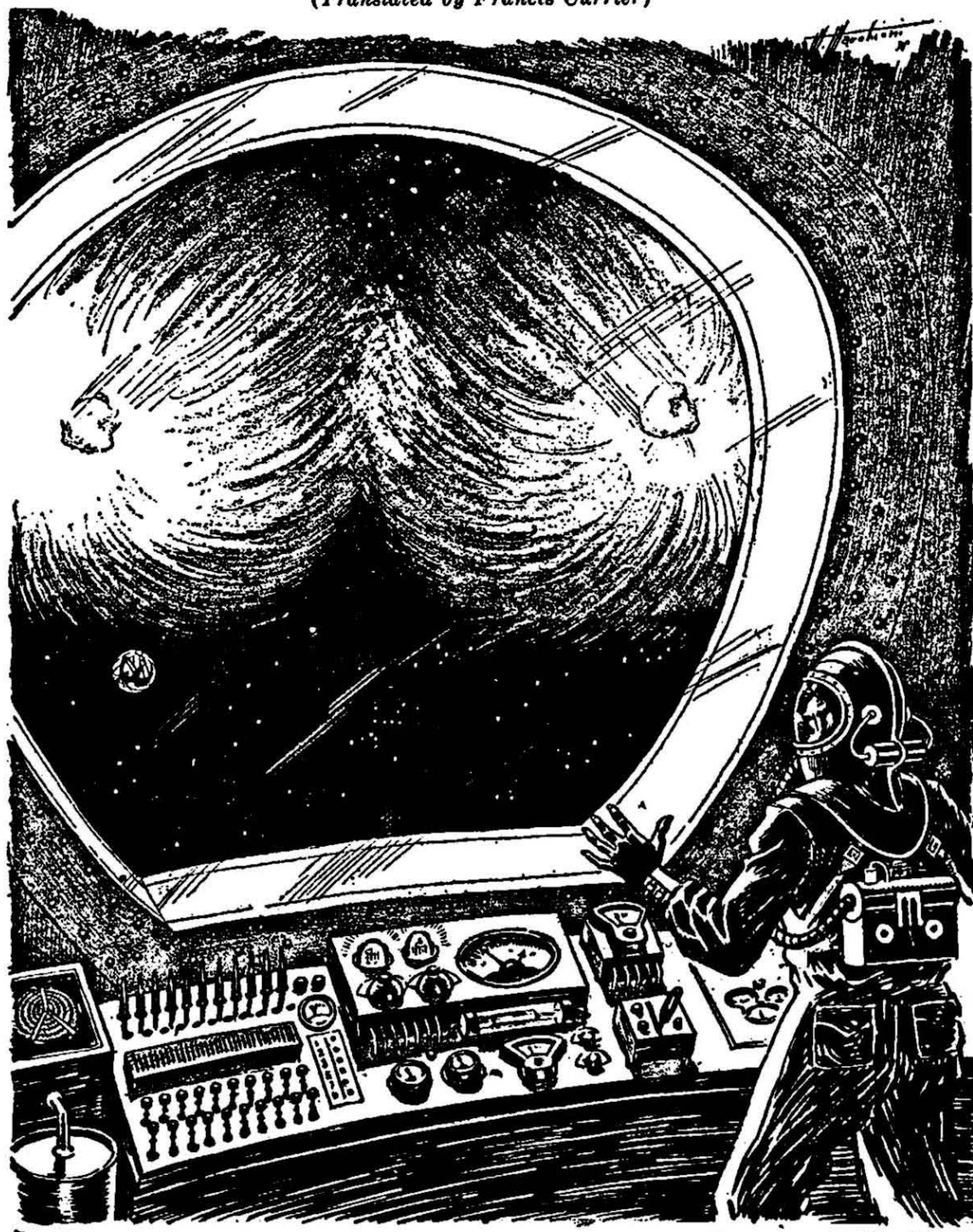
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A Daring Trip to Mars

By Max Valier

(Translated by Francis Currier)



(Illustration by Marchioni)

The minutes seemed like hours. The head of the comet became more and more invisible, more and more transparent the nearer it sped

FOREWORD

THE following narrative offers as entertainment an introduction to the highly interesting problems of the space flight. It is especially aimed at the reader who is not technically trained. The mathematical parts, however, are based on careful calculation. Of course, considerable time must still pass before we shall possess rocket ships so well constructed that we shall be able to venture a flight to a neighboring planet. The rocket ship will first have to stand its test on the earth. Yet it is well to keep the distant goal in sight, even if we are still just making a beginning toward it—MAX VALIER.

* * *

Tom Sacket, chief correspondent of the *Sunday Globe*, had pulled out his pad of paper like lightning. But in his hand, his pen trembled a little.

Accustomed as he was to recording the most hair-raising sensational reports in almost impossible positions, without the twitching of an eyelash, his calmness had deserted him this time. It was only with difficulty that he overcame his excitement. Nevertheless his words were filled with a warm emotion, such as one feels toward dear people who are still standing before one in the abounding freshness of life, but who are to depart the next moment, perhaps for ever.

"Have you actually considered everything?" he asked the engineer.

"This question is idle, my dear fellow. Even a person who intends to pay a visit to

our old moon does not omit to think and plan. But the trip to the moon compared to ours is like a morning walk compared with crossing Africa barefoot."

"Then you intend to go further than—" Tom Sacket with staring eyes stopped in the middle of the sentence.

"Certainly!"

"Then you are not going to the moon at all!"

"Oh, yes, for we unfortunately have to use it as a filling station."

"Why, do you think that—?"

"We do not think anything; we know that on the moon there is to be found what we need in order to produce our fuel by means of solar power. There is ice, which we shall decompose electrolytically into its components, hydrogen and oxygen."

"I wonder whether everything will work out as you think."

"It must, for otherwise we cannot get back again!"

Tom Sacket let the pad sink a moment and looked at the floor. Then he pulled himself together and looked into the clear blue eyes of the engineer, who stood before him like a giant.

"I was going to ask you much more—but I cannot. Not now in this hour, in the space ship which will in a few minutes carry you so far away from our native planet. Whatever your destination may be, whether the red glowing star of the war god or shining Venus, I wish you from my heart the best of success. Good luck for starting and for landing!"

MAX VALIER was not only one of the most distinguished of the German rocket experimenters and enthusiasts, but also the first man to give his life to rocketry. His death in the summer of 1930, occurring by an explosion of an oxygen tank during a test, was a great blow to the rocket pioneers. But it is to be hoped that the example of Valier's enthusiasm and energy animates those who are carrying on where he left off.

The present story was written shortly before his death, and contains many of his ideas about the interplanetary journey which have never appeared in print in English. Valier's command of the interplanetary problem is evident throughout this realistic tale, and his ingenuity in mastering the difficulties of space flight is remarkable. We take great pleasure in presenting this story to our readers as a prophetic glimpse into the future by a courageous and inspired man.

"You have guessed our plan! That is a good omen. If your good wishes come true, we shall meet again in two years, when the earth has returned for the second time to that point in its orbit from which we are now starting. But now I must really ask you to leave the ship. We must get ready for the trip—we must undress ourselves and get into the spring hammocks.

"Oh yes, we have to travel nearly naked, for during the start even the lightest clothing is as heavy as sheet platinum. To be sure, all of us, the doctor, my wife and I, have been tested in the centrifugal machine for ten times the terrestrial gravity, but as far as possible we want to make the activity of heart and lungs easy."

"What, your wife is going with you?"

"Somebody must do the housekeeping, even in the rocket. That is not work for men. And then, who knows whether other planets are not perhaps inhabited? She would surely not want me to succumb to the enticements of the beautiful dwellers in other worlds."

In Space

"ARE you ready? We start in 80 seconds!"

Two voices answered in the affirmative.

"You already know the plans by heart. First, sixteen seconds with only 25 meters* acceleration, until we have gradually penetrated the dense air. Then the gas lever over to the middle point, until at 100,000 meters above sea level we have reached the velocity of 2000 meters a second, 100 seconds after starting. When we are in airless space, then full gas for all the exhausts, as much as the machine and our hearts will stand, so that we can get through the zone of the earth's gravitation.

"Yes, children, we must cover the distance to the moon at an extreme speed, in order

to make up for the day lost by yesterday's delay. Otherwise we shall miss the connection with Mars, and all our painfully worked calculations would be in vain. Instead of taking 49 hours, we shall reach the moon in 19 hours.

"Hello! Still 40 seconds. Have you the hypodermic needles? Then use them without delay, so that the lobelia solution will have still 30 seconds to circulate thoroughly through the blood. And now breathe deeply and just think of one thing, not to stop breathing.—Still 10 seconds. Count with me. Now!"

A blast shook the air. A mighty train of fire shot like a comet up toward the vault of the night sky. And before the few favored ones, who knew about the ascent and were allowed to witness the start, were aware of it, the shining ship had vanished among the stars.

Silently the people went away, most of them slowly, as though the force of the ascent were weighing upon them. Only one had regained his mobility. This was Tom Sacket, who like a true acrobat of the pen was hastily writing his ideas on paper, regardless of the jouncing of the car,

in order that he might wire them to his paper at midnight from the nearest telegraph station. He could not help thinking of the brave, charming, little woman, who, in order not to have her husband go alone, was risking all the dangers of space.

* * * *

At the same second that Sacket's car had to stop at a railroad crossing, the space ship at a height of 1600 kilometers above the surface of the earth had attained the unheard-of-velocity of 10,000 meters a second.* Now the screw of the automatic regulator pushed back the lever which controlled the flow of fuel to the rocket. This



MAX VALIER

*Acceleration of 81 feet per second, per second.

*About $6\frac{1}{2}$ miles a second.

arrangement, regulating the calculated start automatically, at the same time permitting the hand of man to intervene in case of need, had stood the test. Thus every unnecessary motion, every lifting of the hand or moving of the arm, was avoided. And the apparatus did its duty. From second to second the acceleration decreased 0.5 of a meter, being now equivalent to six times the pull of the earth's gravitation, and thus the hearts as well as the entire bodies of the occupants adopted themselves gradually to the state of complete weightlessness, which followed.

The actual start had been successful, without any pressing in of the nose of the ship by air resistance or bulging of the walls due to friction or excessive heating of the ship. As a matter of fact, only such an excellent material as beryllium, which had very recently come into industrial use, could have satisfied these demands for lightness, hardness, and smoothness. Every gram of this rare metal however had cost a full mark.

All the data of importance regarding the start, the flight acceleration, the performance of the rocket, the consumption of fuel, the external and internal temperatures and pressures, were indicated by self-registering instruments. The desolation and emptiness of the long flight through space which was before the voyagers would afford opportunity enough to study and evaluate these curves.

"One of us may now sleep six hours," said the engineer, turning to his companions, without as yet rising from his hammock. "Two of us will always be on duty, twelve hours at a time. We cannot manage otherwise, for it is dangerous to leave one all alone, not alone for physical but also for psychical reasons.

"Who knows what effect the cosmic short-wave radiations may have upon the mind? Whoever finds it his turn to sleep will just stay in bed. The other two will dress and try to get around as well as possible with the aid of the iron-shod shoes, metal insertions in the clothing and the electromagnetic carpet on the floor, because

here gravity has, for the time being, ceased to exist."

"We have noticed that," was the reply, as if from one mouth.

THE lot for sleeping fell to the doctor, the trusted assistant of the engineer. So Inge made herself ready and floated like an angel up to her husband (who had taken the pilot's place in the upper part of the ship). As yet she was not wearing the sandals with iron soles on her pretty feet. And she would have bumped her head against the ceiling of the room, if her husband had not caught her in time with two fingers, just as one catches a bit of down which is hovering in the air.

"I will connect the magnets, so that we can sit side by side, the way we are accustomed to do on earth."

"Yes, do it, Edmund, for with the best will in the world I cannot get used to being an angel living outside the limits of time and space. But it is fine, after all. It is as blissful as though we were falling in dreams from one world into worlds more and more beautiful."

"We are indeed falling, in fact at the enormous speed of about 10,000 meters a second at present, though to be sure falling upward. But this velocity will soon lessen, for the gigantic arm of terrestrial gravitation is still reaching out for us and drawing us back to the earth. But all the power of the earth cannot entirely destroy our tremendous speed."

For a while the two were silent. As yet not a quarter of an hour had passed since the moment of starting, but the time seemed to them like an eternity. This is a phenomenon which the passenger of the Lufthansa becomes acquainted with, when he soars over land and sea in a great trimotor plane. An hour in a plane seems longer than three hours in an express train.

Already the first shade of boredom was beginning to settle upon the couple, when Inge started up with a cry of surprise. Like a red glowing torch, a gigantic arc of light appeared at the edge of the black disc, which was the earth, which stood out

among the constellations, the arc increased every second in luminosity.

Finally the fiery red light changed into a rosy veil, which struggled with shadows edged in blue, and reached out like the jaws of pincers, until a full half-circle was filled. But at this moment there appeared so dazzling a light that Inge had to close her eyes, in order not to be blinded.

She did not venture to look out again until her husband had pushed the dark glasses over her eyes. Meanwhile the picture had changed quickly. As a clear, brightly illuminated crescent the earth stood in the window of the space ship, surrounded by an aureole of changing colored lights, the atmosphere gleaming in the brilliance of the sun.

In the other window there appeared at the same time the image of the bright silver moon, which was illuminated a little beyond its first quarter. With a flight of 19 hours projected it had unfortunately been impossible to make the start from the earth by day.

After all, it was necessary to direct the flight by the moon, which is most favorable for the start to Mars, when it is on the increase as seen from earth and $16\frac{1}{2}$ degrees before its full illumination, because from that position an extremely favorable elliptical path leads to the red star of the war god in relatively short travelling time.

Thus it was unfortunately necessary to give up the real view of the sunny side of their native planet and content themselves with seeing the earth in the form of a huge crescent with an edge shading into twilight slowly moving in the constellations of the zodiac. From the decrease of the angular diameter of the earth, measured from the horns or ends of the crescent, the distance of the space ship from the center of the earth could at any time be secured, and by comparison of the measurements taken from time to time with the sextant, the velocity of flight could also be determined. The same measurements on the diameter of the moon served to check data on the approach of the ship to the earth's satellite.

At last twelve hours had passed since the start. At the first change of watches,

after six hours, Inge had endeavored to serve as hostess, though not without some trouble in accustoming herself to the condition of weightlessness. To be sure, there was no need to worry about breaking dishes or glasses. If they were dropped, they remained floating freely in the air of the room and could only be held fast by the electromagnetic table top because of their iron inlays.

Unfortunately the magnetism could not be extended to the food and drink. The morsels had actually to be juggled, in order to get them to the mouth. On the other hand, drinking out of bottles with the aid of straws offered no special difficulties. Now, the second time, everything went much better. After that Inge withdrew, for the third watch fell to the two men, while the engineer had slept during the second one. For the landing maneuver on the moon at the nineteenth hour they were all to be at their posts, in full complement.

CHAPTER II

Nearing the Moon

"**R**EALLY we have all been frivolous," concluded the engineer, when he had received the report of the previous watch. "We have not bothered at all about shooting stars and meteors but have allowed the Lord to watch out that none of these cosmic blocks of metal burn a hole in the covering of our ship. To be sure, we have rubber patches and fasteners at hand, to be able to close the leak as quick as lightning.

"But, to speak frankly, I do not think we should be able to get around to doing that, unless we were to sit here all the time in our space diving suits. For if the hole in the wall is of any size, then the air would escape from the room too quickly. Even the automatic ventilators will not be able to keep up the air pressure until the leak is mended, and anybody in the room where the catastrophe occurs will die. For his veins will burst, if the pressure sinks below one third of an atmosphere. Besides that there is the cooling of the gases to far be-

low zero on account of the rapid expansion."

"Fine prospects, those," replied the doctor, "is what people would say on the earth, if this was explained there for the first time. But we have considered all these things a hundred times already and have just accepted them."

"I do not see why we should not be able to get out of the way, since the ship obeys the steering gyroscope so well and the exhausts ignite in a fraction of a second," said Inge with energetic decision. She was already in her hammock.

"But my dear child, what is the use of all that? If we could see the approaching meteor in time, we could do something."

"Why can't we see it?"

"If we all three lay day and night at the telescopes, like setters out hunting, perhaps we could. But that cannot be done, and even if it could, all the meteors would escape us which were not in the limited field of vision of the telescopes. With the naked eye recognition of them is impossible. Further, remember that our highest velocity is 10,000 meters a second while meteors in crossing the orbit of the earth are known to possess velocities of 40,000 to 70,000 meters a second.

"One second before collision, meteor and ship are therefore still 50 to 80 kilometers apart. How is one then, even with a keen telescope, to perceive the body, which perhaps is only a few decimeters or centimeters in diameter, which neither glows nor shines in the cold airless space, apart from the tiny bit of sunlight it reflects!

"In fact, we can do nothing, madam, except trust in God. If chance or destiny wills it, we shall be struck, or we shall emerge uninjured from this cosmic drum fire, which doubtless, even now, is invisibly going on every hour and minute about us. In my opinion it is just the large meteors which we have to fear least, because they are the rarest.

"But it would be bad if we got into a thick swarm of very tiny meteoric bodies, as if into a sandstorm. Then certainly we would be lost, for these little particles would act on our ship like a sand blast

and would grind off the outer skin as though on a grindstone, until the covering burst and the inner ship also was finally ruined.

"My greatest concern is whether the insulating stratum of ozone which is between the double walls of our cabin in order to check the deadly short-wave gamma rays of space, would prove effective. That too is quite aside from the powerful ultra-violet rays, which alone would completely burn up the body.

"The window panes, cast in Jena out of a specially designed glass, have certainly stood the test excellently, as well as the complete system for artificial renewal of air from Hanover." In satisfaction the engineer looked around the narrow but comfortable room, in which every single thing, however tiny, had its purpose and was absolutely necessary.

"Before I go to sleep now, don't you want to take a little walk outside the ship in the brand new space suits?" The doctor nodded affirmatively. Then a bell sounded.

"That is the signal that we have passed the limit of gravity between the earth and the moon. Now we have been *en route* 12 hours and 17 minutes. The time agrees tolerably well with the calculation. The velocity amounts to about 1400 meters a second, too much for the start of our fall to the moon. It will have to be braked considerably. I could start that right now, but to shorten the flight let us keep on to 1000 kilometers above the surface of the moon. Our four exhaust brakes will stop us all right even then."

IN fact, without that signal which was given by an ingenious selenium photo-electric televisior, as soon as the disk of the moon enlarged beyond a certain size on the projection surface, which corresponded to the previously calculated distance of the point free from gravitation, they would not have noticed at all that the ship had now passed from the sphere of influence of the earth into that of its satellite.

It is just in this point that previous novelists have made so many errors. The pressure of gravity does not gradually decrease between the start from the earth to the point

free from gravity, so that the occupants feel lighter and lighter from hour to hour, until they float about entirely weightless at the moment when the ship passes the limit of gravitation.

On the contrary, all pressure ceases for them at that moment, a slight distance above the earth, when the rocket is shut off; it begins again only when the pilot sets the engines in operation in some direction of flight.

It is equally wrong to maintain that the ship, on passing the limit of gravitation, turns around of its own accord and now turns its bottom toward the moon so that in consequence the ideas of above and below are changed for the occupants.

Even the ideas of up and down have lost their significance for the occupants at only 1600 kilometers above the sea level coincident with the disappearance of the pressure of gravity. Neither the earth nor the moon is then above or below; they float the same as the ship in space, simply ahead or behind, to the right or the left.

The doctor had already opened the cupboard in which the space suits were stored. But the engineer shook his head and went on, turning to his wife, "Just sleep calmly, my child, we will remain here and turn around the ship, so that the exhaust end will be directed toward the moon. Then we will get out the large distance measurer, for we can no longer measure with the sextant when so close to the moon. I think you will have only about five hours sleep, for we are arriving rather earlier than the calculation indicated. But in this case it does no harm."

Inge switched off the light in her berth and drew over her head a light downy coverlet. To hasten the coming of sleep, she pressed a button which caused to flow toward her a slightly narcotizing gas, which the travellers through space called "sleeping gas". Of course the gas flowed only for an automatically regulated time, in order not to have a bad effect upon the respiration.

Meanwhile the two men set to work. Since there was nothing else to be feared, the doctor took the pilot's seat and started the gyroscope, whose rotation by the re-

sulting momentum of revolution forced the entire hull of the ship to turn slowly in the opposite direction, until the bow pointed almost exactly toward the earth, while the exhaust end pointed to the moon. Meanwhile the engineer climbed down into the lower room, in order to convince himself about the condition of the tanks and their contents. The ship carried fuel in immense quantities, while the oxygen necessary for combustion was kept separate. The composition was still the secret of the inventor.

The total load of fuel was of such an amount that on being burned all in succession, in airless and weightless space, working only against the mass inertia of the ship itself, it could have imparted to the latter a final velocity of 16,000 meters a second. In technical language that is called the "ideal propulsion".

This measurement number is the most important of all, for it determines the radius of action of the space ship, since every specified trip in space, after careful calculation, expresses by this single number the ideal propulsion necessary for its accomplishment.

For Landing!

FOR the ascent from the earth, the ship had already used up about 13,000 meters a second of its propulsion possibility. Only 3000 meters a second were left for braking the fall toward the moon. This had to suffice to overcome the field of gravity of the moon, equivalent to 2400 meters a second, plus the power to brake the tremendous velocity with which the ship had just shot past the limit of gravity.

Regarding the amount of fuel still on hand the engineer was naturally informed beforehand, for an indicator which could be read from the pilot's seat showed at every moment the condition of the tanks. Likewise manometers and thermometers showed the pressures and internal temperatures in the different containers.

The engineer's one anxiety was concerned with the parts of the ship's motor which were necessarily exposed to the airless and cold interplanetary space, that is to say, the exhausts, the rocket explosion chambers,

and the vaporizers and spark plugs projecting into them. Without interference all these parts would have cooled off, when the rockets were shut off, nearly down to the temperature of space, that is, to below 250 degrees below zero (Centigrade).

There was danger that they would split, if the combustion chambers cracked at all, due to the sudden change in temperature. Failure here would mean certain death through the smashing of the ship, when it struck the surface of the moon with twice the speed of the shell of a cannon.

The walls of the exhausts, like all the metal parts of the ship involving high temperatures, requiring at the same time great smoothness and hardness, were made of beryllium. This metal had in addition to the favorable properties of duralumin also the advantages mentioned and besides that of a specific gravity one-third smaller. The actual walls of the chambers were made of quartz glass blown in one piece.

To protect all these delicate parts against extreme cooling, the engineer had made a very ingenious arrangement. The same system of coils which served for circulating the cooling material during the operation of the rockets now had passing through it some warming material preheated in a special boiler, so that the temperature of the endangered parts could not fall below a certain point. For this reason the rockets could not be shut off suddenly nor could full gas be given instantaneously.

Carefully the engineer tested every part of the machinery, the pumps, the valves, everything, down to the smallest screw. That this was no trifling task is known to anyone who has ever had to go over a twelve-cylinder airplane motor. What are called cylinders in that case were here twelve rocket chambers arranged in star form about the main axis of the ship, each of them opening out into an exhaust composed of seven hexagons, again arranged in a star shape.

Thus the hours in the engine room passed quickly for the man who in the pilot's seat, took observations on the approaching moon. He did this partly to fulfill his duty and partly also for his own pleasure, to pass the time. He used the great telescope which

was built into the main axis of the ship, always pointing directly along the line of flight, and which gave an enlargement of 1000 times. Since the ship in the course of these hours had descended from about 30,000 kilometers to about 10,000 kilometers above the surface of the moon, he saw the landscapes below him in the telescope as clearly as though they appeared to the naked eye at heights ranging 30 to 10 kilometers.

By using the micrometer built into the tube to take angular measurements of the little crater of Triesnecker, whose diameter was well known from the measurements made by terrestrial observatories, and by using as a check the distance apart of two tiny craters between Triesnecker and Hyginus, he got by readings every five minutes, the exact distance of the ship from the moon. By calculation he also got the velocity at each time. This was now increasing every minute.

Quickly there passed the last hour, the eighteenth since the start from the earth. In the next thirty minutes everything was to be settled. Life or death! It all depended on whether the landing was successful or not. There was no third possibility. If there was the slightest failure, then there was not the remotest and dimmest hope of survival.

IN climbing up from the engine room the engineer had wakened his wife with a kiss and had then taken the pilot's seat, while the doctor took a place at the left. Inge floated up to the men and seated herself at the right of her husband. At first she was much astonished that she no longer saw the moon through the forward windows, for the doctor had imperceptibly turned the ship while she was asleep. Now the crescent of the earth appeared in the uppermost window of the dome, a splendid sight, about four times as large as the crescent of the new moon appears on earth.

The great telescope was no longer used for examining the moon. The smaller telescopes, enlarging twelve times, were sufficient for the purpose. Nearer and nearer came the satellite, but it no longer looked

as though the ship were falling upon it. It seemed as though the moon were floating forward like a golden iceberg on the invisible tide of the ether, a demon lying in wait for them. The approach of the globe, shining in the sunlight, had something pitiless and devastating about it.

"It is like a sea of glass blended with fire," said Inge softly to herself, without expecting a reply. "Like a monster with a hundred eyes on all sides, which is rising before the throne and about the throne of the infinite, as is written in the Apocalypse of St. John, the seer of Patmos."

With magic power the moon drew the glances of the men. They had to tear themselves away from the view of the horrible wilderness of its crater fields every few moments, to look at the indicators of the measuring instruments on the dashboard. Finally the engineer broke the silence.

"Children, it is getting time to prepare for landing. So be quick, my dear, and get into your hammock. Take off all the blankets and any superfluous clothing. We shall have to brake sharply, and this time the pressure will strike us like a bullet even if in the absolute sense it will not be quite as strong as at the start. On the other hand, for eighteen hours we have been unaccustomed to the normal terrestrial gravity, and even that would now seem an unusual burden."

As obediently as a child Inge withdrew to her berth and obeyed instructions. Likewise the men took off their clothing so far as was necessary. The engineer examined his muscles tentatively. Their development was due to diligent practice in gymnastics and carefully planned training in boxing.

"Now we must give the old moon the knock-out! This will not be so easy, because for landing on it there is no possibility of using the automatic regulator of the lever. It will be necessary to throw the gas lever by our own muscular force, and that after a lightning-like decision, as the emergency demands.

"This with the quadrupled pressure will demand at least as much expenditure of force as if one tried to hold up a hundred pounds in one hand. If only our nerve

responses do not fail, Edmund! To be frank, at the start I was somewhat stupefied, and I was glad that the automatic device took care of the gas regulation so perfectly."

"Yes, it is no joke to speed toward such a wall of armor as the crater-pierced moon at a speed of 2000 meters a second. Remember that the speed with which the nerves conduct the visual stimulus to the brain and the command to the arm muscles amounts to hardly more than 15 meters a second. But now there is no more time to be lost."

"Do not forget the injection," called the doctor to Inge, while he inserted the hypodermic and the engineer did the same.

The latter allowed thirty seconds to elapse, in order to give the drug time to be imparted to the body. Then he asked briefly: "All ready?"

CHAPTER III

On the Moon!

THE distance from the moon had meanwhile lessened to about 1000 kilometers, while the velocity of fall was almost 3000 meters a second. Then the engineer reached out for the gas lever and pressed his foot on the starter.

At once there was a buzzing sound in the ship. The pumps began to operate and forced the liquid fuel into the vaporizers. Now a pressure on the lever switched on the ignition. At this moment an invisible veil seemed to be cast over the occupants. For an instant their brains seemed to cease functioning. It was the coming of the pressure, small though perceptible. The engineer was the first to recover himself.

"The transition from no gravity to a slight amount is always the worst, and the body will endure better the increasing of a sensation already present." Turning to Inge, he went, "Do not worry, my child, we are ourselves again, and I feel strong enough to strangle a lion."

Meanwhile the indicators of the measuring apparatus had begun to operate. They were attentively observed by the doctor, who had to see that the heating gas was removed at the right time and cooling mater-

ial provided instead, in proportion as the internal temperature of the quartz wall of the combustion chambers rose to a white heat.

"The chambers are warm," he reported. "Now you can give gas as you please, Edmund." The latter called back in a loud voice, so that Inge heard it above the hum of the motors:

"Pay attention! I am now braking in the first stage with a maximum of 40 meters a second* retardation, in order to reduce the fall toward the moon from 3000 meters a second to 600 meters a second, in exactly one minute. Now!"

If anybody could have seen the ship from the outside at this moment, he would have noticed that in a sudden flame it shot a brilliant train of fire toward the moon. This lasted exactly 60 seconds. Then the blaze disappeared, but it was replaced by the emerging from the ship, at a right angle to the axis, of a symmetrical tube, looking like the eyes of a snail, with spherical knobs on the ends, shining with lenses.

The engineer had put out the great distance-measurer, for the telescopes were no longer sufficient in this case, when it was a question of checking the plunge to the moon to a fine point. With both eyes at the instrument he could see the surface of the moon run like a speeding locomotive through the distance marks of the stereoscopically acting tube which were in the field of vision, and could calculate from the time between one mark and another the velocity at the moment. The doctor announced by way of checking the observations, "850 kilometers above the moon; velocity of 590 meters a second, as the result of the first stage of braking."

"That agrees approximately," replied the engineer. "The small difference from my reading is insignificant. The chief speed of fall is checked. Now I shall allow us to fall to 400 kilometers above the moon, during which our velocity will again increase a few meters a second, and then I'll brake in the second stage to 50 meters a second."

And so it happened. The exhausts did

their duty. The distance measurer showed only 14 kilometers of height above the moon, when the maneuver was finished. Then the engineer turned to the doctor.

"Now we can take in the great distance measurer, so that it will not be injured on landing."

The latter quickly executed this.

Then the engineer for the third time threw in the lever and checked the ship 500 meters above the moon, so that it neither rose nor fell. From there he gently allowed it to float down and deposited it finally on the surface of the moon with a gentle impact.

"That was a master work, no less than that of the valiant man at Krupp's who made the head of the huge steam hammer come down so accurately on the emperor's gold watch without injuring it, that it could not be pulled out," was the praise of the doctor, while Inge rewarded her husband with a kiss.

HARDLY had the latter convinced himself that the ship was resting on solid ground, then he was already slipping into the space suit.

This was provided on a small scale with all the equipment of the cabin, i.e. with apparatus for artificial breathing, electric heating, insulation against radiation by means of a coating soaked in various preparations, and telephone wires for speaking across the airless space. Bowie knife, axe, hatchet, and spade, as well as the inevitable repeating pistol were of course provided, even though there was no expectation of hostile inhabitants. In a special carrier there were stowed scientific registering apparatus in such a way that they could at any moment come into action.

The doctor helped Inge into her diving helmet.

Then the two climbed in turn into the air-lock chamber and left the ship in the same manner as is done in submarines under water. Even though the diving equipment weighed a hundred pounds according to terrestrial weight, it was easy to endure with the gravity of the moon only a sixth as great.

The engineer had judged correctly for

*Deceleration of 135 feet per second, per second.

the ground on which the space ship had landed consisted of ice. Whether the entire surface of the moon was formed of the same substance, could not be determined from here.

"But that does not matter to us," he called into the telephone, by which he was connected with his wife and the doctor, who was remaining on board as a guard. "Here we have what we want. Now be quick, get out the solar power apparatus and send it down to us from the air-lock by the crane. We must utilize every hour."

The tanks of the space ship, which was built for an ideal propulsion power of 16,000 meters a second, had been almost entirely emptied by this excessively fast trip at a prodigious speed. The power of 13,000 meters a second had been consumed by the ascent from the earth to the weightless point, and the power of almost 3000 meters a second had gone to the braking maneuvers in landing on the moon.

Since a one-way direct flight from the earth to Mars on the chosen ellipse, would have required about 16,000 meters a second without taking account of any steering maneuvers, a trip to this planet with the given engine power would have been impossible. It was another matter, if the moon could be used as an intermediate station. Then the ship, starting from the moon for Mars, had only to overcome the moon's field of gravity, produce the excess of parabolic velocity at the moon's height in the earth's field and finally the acceleration for getting into the Kepler path to Mars. All of this amounted to an ideal propulsion of 9350 meters a second leaving, of the 16,000 meters a second available, the amount of 6650 for maneuvering on the trip to Mars.

A few hours later the little power station was in operation. A huge parabolic mirror built of light sheet silver collected the intense heat of the sun and first melted a small amount of ice in a closed container. The water thus formed—which cannot exist free on the airless moon—was heated to boiling, and provided the steam for a little turbine. This was connected with a generator of electric energy, whose current was

used for the electrolytic dissociation of melted ice in special containers.

The entire system was of such dimensions that in four terrestrial days it would exactly fill the tanks of the ship with liquid hydrogen and oxygen in the right proportions.

The Second Lap

THEREFORE they had to remain this length of time on the moon, while the power plant operated automatically. Naturally the travellers used this time for making cosmic studies and for investigating the surface of the moon. It was sufficient for only one person to remain on guard in the ship at all times.

Substances directly serviceable or valuable were indeed not found on the moon, but the doctor, who had taken his degree in both medicine and chemistry, came on the trail of an important discovery. When the short-wave gamma radiations of space were concentrated in the shadow of the crater wall, where the sun did not reach, by directing a parabolic mirror toward the Milky Way, he found that the rate of decomposition of radioactive substances, of which a few samples had been taken along, was considerably accelerated and in fact regulated according to desire.

This experiment would never have succeeded on the earth, to whose surface there penetrates only the radiation filtered by the air. It indicated the initial step in the technically controlled demolition of atoms and the obtaining of the enormous energy latent in the breaking up of matter.

"Here we have the key to the real ship of the future," he explained impressively to Inge, who had followed his experiments with astonished eyes. "Our present rockets, which simply operate by the energy of detonating explosives, i. e. through the decomposition and rebuilding of molecules, are poor weak little machines, which can hardly accelerate us to the velocity of 42 kilometers a second which is necessary in order to leave the solar system. That feat will only be possible with ether ships which hurl the split-off electrons of crushed atoms

out of cathode tubes with almost the speed of light.

"Those tubes will take the place of our exhausts. Of course such ships can only set out from the airless moon, never from the air-wrapped earth. Therefore the explosion rockets will be used to get us to the moon. The ether ships themselves, with an easily endurable acceleration of only 20 meters a second a second will be able in the course of a half year to reach the velocity of light. At full speed such a ship would then cover the distance from the earth to the moon, which took us 19 hours, in less than $1\frac{1}{2}$ hours, and to Neptune in $4\frac{1}{2}$ hours. It would even offer the possibility of reaching the neighboring fixed stars, such as Alpha Centauri, Sirius, and Procyon, which according to current figures of astronomers are 4.2, 8.7, and 10 light years away from us."

Inge listened intently to these high-flown plans for the future. They were full of credulous confidence in the power of the human mind, which before her very eyes had just completed its mightiest feat by reaching the moon.

Thus the four days passed quickly, and the time came to dismount the power plant and to stow the parts again in the space ship.

"Now I will quickly try to fulfill your request, Inge," said the engineer, turning to his little wife, just as she was starting to hand the men their last breakfast on the moon. "You wanted so much to send a few farewell greeting to our old earth. It cannot be done by radio, for it is not even certain, on the one hand, whether the waves used by our terrestrial stations today are those necessary for wireless communication via space. And on the other hand the apparatus necessary would have been far too heavy to bring along. But the trick can be done by the solar mirror. Previously I could not put it at your disposal, until I was sure that the power plant would really fill our tanks in the calculated time."

Frau Inge filled the men's cups by pouring—a thing possible to travellers through space only during a stop at a heavenly body

of sufficient force of attraction. The doctor took up the conversation.

"The mirror has done its work splendidly. Our tanks and all the reserve containers are filled to bursting. But now we have still six hours before the calculated moment of starting. We need three hours for taking apart and stowing away the machine, and so we have three for fulfilling Inge's wishes."

"I am childishly glad of that. But I by no means understand how you are actually going to do it, for after all the parabolic mirror collects the rays arriving parallel in its focal line. But here it is the same idea as with an automobile light, of sending a parallel pencil of rays into space in the opposite direction from a source of light."

HOW cleverly you speak. As a matter of fact, we shall have to change the mirror, which was built for this beforehand, and stretch it out flat as a plane mirror. This can be done quickly by adjusting its framework. Then we will simply catch the sunlight with it and flash it, like a window on a mountainside on earth, to our native planet.

"On earth my friend, the Peissenberg astronomer is already on the watch for it. Before starting I gave him an exact description of our plans in a sealed letter and informed him that, if it were at all possible, we would signal five hours before our indicated starting time from the moon to Mars. The time is also favorable, because the mirror, thanks to its elevated position is in the sunlight, while the district for a great distance around is still buried in the pitch-black shadow of the crater walls.

"On the bright background of the moon our mirror-light could presumably not be seen from the earth, or its discovery would at least be very difficult. But in the pitch-black shadow the bright flash will very probably be recognizable. By swinging the mirror on its own axis, we can give at will long and short light signals and communicate in the Morse code."

An hour later all three were at work informing their friend on the earth of the results of the trip thus far and their future

prospects and intentions. They gave the signals in rapid succession, repeating each sentence for security. All this went smoothly, only it was uncertain whether the observer on the earth had clear weather for reception. On the other hand, it might well be assumed that he would have notified other observatories in case he had bad weather.

Finally the report was sent that at an exact time after leaving the moon, when the ship as viewed from the earth would be a certain number of degrees in a certain direction from the disk of the now nearly full moon and among the stars of a certain constellation, they would send Morse signals by switching on and off the cabin lights. This was more in the nature of an interesting experiment, for it was questionable whether this incomparably small gleam of light could be perceived even by the largest telescopes on the earth.

Then the men set to work, and soon the mirror was taken apart into its silver strips and rolled up, while the lattice work of its support was stowed away. With the crane the last heavy machine parts were hoisted on board, and the openings were carefully closed. The fuel feeds had already been changed and adapted for operation with liquid hydrogen and liquid oxygen, while on starting from the earth they had used the more convenient though somewhat weaker nitro-benzene, which unfortunately could not be replaced en route.

Meanwhile the moon, as viewed from the earth, had reached a position $16\frac{1}{2}$ degrees before full. Accordingly, the tangent to its orbit cut the orbit of the earth at this angle, also, and if travelled on at the right speed would lead to an ellipse which would exactly meet the orbit of Mars with a travelling time of only 171 days, as compared with 260 days if the start had been made in an ellipse tangential to the earth's orbit.

The saving of 90 days could not be scorned, if one considered that the vital requirement in solid and liquid food and in air to breathe including the requisite chemicals for its production amounted to some eight kilograms per person per day. For just a one-way trip the saving in load for four persons would be $4\frac{1}{2}$ tons.

CHAPTER IV

Coming Madness!

THE start had taken place smoothly, and the attempt to signal by means of the cabin light had been made. Whether this had been successful, it was not possible to determine. But now the ship was rushing through the fearful abyss of space at a velocity of about 9 kilometers a second relative to the earth, at 31.80 kilometers a second relative to the sun.

The moon shrank into a rapidly diminishing crescent, while the earth completely disappeared, because the ship was now exactly on its night side. This was indeed disturbing, but the doctor remarked that it was always more important to have the heavenly body to which they were going in full sunlight before them, than the one which they were leaving behind.

* * *

Fifteen weeks of the twenty-four which the trip was to last had already vanished into the insatiable maw of the past, without the occurrence of anything remarkable. The travellers had long since become accustomed to the condition of the weightlessness. It was much harder to put up with the unescapable boredom. In the long run nothing would help the three, already they were getting into an excitable mood.

They quarrelled, merely in order to quarrel and to prove to themselves that they were actually still alive and not lying in an eternal sleep. These mutual torments slowly took on a more threatening form. When the science fiction novelists have written about space flights and depicted a mutiny of the crew or something of that sort, they have shown something psychologically well founded. But among the engineer, the doctor, and Inge it went no farther than rudenesses, but rudeness which they would never have pardoned under terrestrial conditions. In the case of crews of baser stock there would actually have been mutinies and stabbings.

At length they longed intensely for a change. They felt themselves in prison, even more than if they had been in the

notorious Venetian lead chambers; and finally all their desire was directed at bursting the narrow walls of the ship. In an attack of such space madness the engineer had once come near beating with his fists on the switchboard of the levers and smashing the glass coverings of the delicate indicating apparatus.

It was only with difficulty that the doctor and Inge together were able to calm him, since his strength was not held in check by the limitations of terrestrial gravity.

On another occasion—contrary to the previously agreed on duty schedule—when both men were sleeping at the same time, with only Inge on guard at the controls, she was seized by an irresistible desire to move the gas lever, to ignite the rockets, and to commence a mad flight through space, without regard to the calculated course. She had already set the starter to work, when her husband, awakened by the humming of the pumps, sprang up and pulled her back just as she was going to throw the great gas lever forward.

* * *

The twentieth week was drawing to a close.

"If only something would happen!" screamed the engineer, striking the table with his fist. "I cannot stand this any longer!"

"The devil has bewitched our ship, just as he did to the three-master of the Flying Dutchman," replied the doctor.

"Aren't you two ashamed to talk that way? Perhaps good spirits are accompanying our rocket and keeping away the meteors which otherwise would have long since smashed it."

"Well, do you believe, my dear lady, first in spirits and then in the kind that catch meteors in cosmic butterfly nets, in order to keep us safe from these mosquitos of space? I don't."

The engineer stepped indifferently to the forward window. His attitude was not that of the responsible captain, for they had all long since forgotten all ship's discipline and no longer stuck to hours on duty with free intervals between.

OUT there Mars was shining, still looking like a star, though just as bright or even brighter than Venus appears to the eye of the dweller on earth, when it shines with its greatest brilliance as the evening star. It was still about seven million kilometers away, but the ship was catching up from behind at an excess speed of some four kilometers a second.

On more exact observation it could be recognized even with the naked eye as a tiny half illuminated disk. And with only an enlargement of 100 times in the telescope the image was clearer than with a 1000 time enlargement by observatories on the earth at the most favorable opposition of Mars.

Just for pleasure, the engineer was about to adjust the keen glass to Mars, when he noticed a tiny luminous point moving slightly in the field of vision of the telescope, a thing which was striking because it was just passing between two fixed stars located very close together.

"At last something interesting, children," he called over to the other two. "Come and look at the little star; I do not know whether I am seeing badly or whether the lenses are getting coated."

Inge looked through the glass, then the doctor. Both admitted that the body looked misty to them also.

"Then it is a comet," decided the engineer. "For to differentiate between comets and the little planets or asteroids today the orbit does not serve as an indication but the tail or misty covering does."

The doctor plunged into some books and suddenly developed a quite unsuspected zeal in working the slide rule. Then he reported, "This is not one of the known comets which are now en route and crossing our path, for none of them, seen from our present position, can be in this direction."

Meanwhile Inge and her husband were attentively watching the course of the new heavenly body, which was gradually increasing in size and luminosity and after a few hours attained the size of the full moon, though actually only as a washed out path of mist with a bright nucleus. At length, after the second hour following the dis-

covery, a sort of explosion seemed to occur on the comet. Suddenly a sheaf of luminous matter rose from the nucleus, at once curving into a fountain-like jet, which escaped into space in the direction away from the sun. Now the brilliance of the phenomenon increased unceasingly, and soon the comet surpassed Mars in total luminosity.

"Unfortunately the determination of the distance by the method of orbit calculation is not yet possible," explained the doctor. "We must wait a while, but I estimate that this thing is still a good 10 million kilometers behind the orbit of Mars, which it will cross at the parabolic speed of about 34 kilometers a second. So it is approaching us daily by about 3 million kilometers and will presumably cross the path of our space ship in four days, if it does not actually collide with us."

At this conclusion Inge shuddered. What they had all desired, the great cosmic event, had arrived, but now it was already filling them more with anxiety than with joy. The comet had however one good effect: the quarrels ceased, and the performance of duty was again rigidly adhered to.

On the third day, when Inge was sitting alone at the lookout post and had adjusted the telescope in order to get a better look, she was horrified when she turned the telescope to the comet. Now it stood among seven fixed stars, with its head up, from which gases streamed and curved around with the effect of parted hair, while the streams joined together farther below and the comet's tail hung down like a flowing beard. The nucleus had divided into two luminous centers, which glowed like fiery eyes. The whole thing looked like a threatening spirit blocking the way with angry glances.

Then Inge thought of the words of St. John, in the mystic Revelation, which is written in the first chapter, verses 13 to 16: "And in the midst of the seven candlesticks one like unto the Son of man . . . his head and his hairs were white like wool . . . and his eyes were as a flame of fire . . . and he had in his right hand seven stars : and out of his mouth went a sharp

two-edged sword : and his countenance was as the sun shineth in his strength."

Into the Mists!

AND as a matter of fact, the two-edged sword was not lacking. A spear-like jet of gas, short and dazzlingly bright, was just shooting out toward the sun, a thing the terrestrial astronomers call the formation of an abnormal comet's tail. As if that was not enough, the picture became still more frightful.

The normal emissions of gas from both nuclei were now being so evolved that they formed something like two horns above the head of the comet, while the two eyes moved farther part and took a lower position in the image of the head, leaving between them a relatively dark space open, which opened before the ship like the black jaws of a monster with wide apart, deeply basilisk eyes.

With a shriek Inge tottered back and would have fallen from the steersman's seat, if this had been at all possible in the condition of weightlessness. Then the two men sprang up and rushed to the levers and apparatus.

It was high time. The comet, whose distance from the ship could in no way be exactly determined, since the faint contours of the wanderer afforded no measurements, was nevertheless much nearer to the ship than the doctor had estimated, and now it was rushing straight at them. It now looked like a mad bull with the countenance of a dragon. Now everything was at stake!

"All clear to maneuver!" ordered the engineer. "Have the spare suits at hand. I think it will be better for us to put the suits right on, for on colliding with the comet—if it comes to that—a splinter of the monster can easily pierce the ship, and allow the air in the cabin to escape. If we have our suits on, absence of air cannot harm us, only if one is actually struck is he lost."

In order to reduce the probability of all being struck together, the engineer arranged that Inge should remain amidships in the cabin, the doctor should climb down

into the engine room, while he himself took the pilot's position in the conning tower. Then all the bulkheads in the ship were closed. The great distance measurer was again pushed out and took in the comet with its stereoscopic jaws.

From minute to minute the engineer read off the positions and called them through the wire to the doctor, who was down in the engine room trying as best he could to calculate the relative path of the comet to the ship. Soon it was evident that diverging to one side would have required such great acceleration that the machinery could not have produced it. This would also have demanded so much fuel that even in case of success the return to the earth would have been questionable.

There was nothing to be done but to accept the struggle and to try to pass between the two nuclei of the comet, right through the black jaws, when it was to be hoped that the slight mass of the cometary nuclei would not cause too much disturbance of their path and attract the ship into a disastrous course. The only things to be feared were direct hits by splinters, the friction of the comet gases on the walls of the ship, and sand blast effects on the skin of the ship. But there was no choice.

With his eyes fixed on the distant measurer, his hands on the levers, the engineer was like the record driver who knows that the dangerous S-curve is now coming, which determines life or death. A pressure of his foot set the starter in operation. And when the combustion chambers were warm, the hand on the lever gave a little gas. It was not necessary to turn the ship around, for here the adversary was to be attacked from in front.

The minutes seemed hours. The head of the comet, probably ten times as great in diameter as our earth, became more and more invisible, more and more transparent, the nearer it sped, for its gassy veil was being spread over an ever greater space in the sky.

"We will not notice at all when we are in it, Edmund," cried Inge through the telephone, when she noticed this. "If only the comet's nuclei were behind us!"

At this moment the needles of the external thermometers began to quiver and rise. Soon they mounted to 100, then to 200 degrees Centigrade.

"We are in the mists," said the doctor from the machine room, for he too could look ahead through a periscopic telescope.

The pointers rose to 300 degrees. Anxiously the engineer called into the telephone, "If that keeps on, the outer wall will soon be red hot. But we will stand it a while. The beryllium has a high melting point, and it will take at least ten minutes for the heat to be conducted through the insulating layer. Then there will really be danger that the tanks may explode."

"There, there, look!" screamed Inge. "The nuclei are rushing at us. The left one is nearer."

"**L**OOK out, I must give full gas," shouted back the engineer, to be heard above the humming. "Then we will make a sharp turn to the right. We must get through the middle, as closely as possible, and then we will have the fields of gravity of the nuclei balancing each other." Already the steering gyroscope was buzzing and was swinging the nose of the ship to the right. Five seconds later all the chambers were expelling their fearful sheaves of flame into space. But the people in the ship were panting and writhing in their heavy space suits.

Still the temperature at the outer wall kept rising and had passed 600 degrees, when the ship flew between the two nuclei at the speed of nearly 60 kilometers a second, for it had 25 itself and the comet was shooting in the other direction at about 35. The nuclei, some 20,000 kilometers apart, looked like swarms of arc lights, circling in a fog like flies.

Then there was a blow against the wall. The engineer at once called through the wire to Inge and his friend. Inge immediately replied, but the doctor's voice sounded hollow and weak.

"A break! One tank is running out. Two chambers are spitting. I, I am. . . I am. . ." Then the connection broke

off. Inge inquired, "Shall I try to help him?"

"Impossible now! Wait! Five minutes more!"

When two combustion chambers on one side gave out the rocket threatened to turn over, as sometimes occurs in the case of artillery shells. This the engineer could only avert by shutting off two chambers on the other side. Before this was properly managed, three minutes had passed. The outside temperatures were still rising, and there was the danger that the tanks would soon explode. There was only one way out to be tried: attempting to get out of the fog in the shortest way by cutting across the direction of the tail of the comet.

Quickly the engineer seized the wheel. His decision was reached. All would be settled in the next few seconds. Fuel?—The more used up now the better, for then the tanks would not explode so readily through heating.

Once more the man at the controls pushed the lever to its full extent and turned the steering wheel for the sharpest lateral turn. Almost unwillingly, the ship obeyed. The task, performed with superhuman muscular effort against the fearful pressure, was successful. The patches of mist became thinner, and soon the stars shone clearly from the depths of the heavens. The ship was saved, the utmost peril averted.

In the upper room everything was in order. The suits could be taken off, which Inge at once did, for she was already at the end of her strength. But the engineer, still in his helmet, crawled into the airlock of the descending shaft and closed the upper cover before opening the lower one.

And that was well, for the air in the lower room of the ship had escaped. To be sure, that alone could not have hurt the doctor. And in fact the engineer found him in a corner wedged in between two duralumin braces which had bent somewhat. Otherwise he was all right and in good spirits. First the leak had to be made airtight, which was quickly done by means of the previously prepared plates and rubber inlays. Then the engineer filled the lower room of the ship again with fresh air from the reserve

tanks. Then he once more climbed up to the upper room where Inge was, removed his helmet, got some tools out of the chest, and climbed down again, in order to free the doctor from his confinement, which he managed to do after some effort. A few minutes later the doctor was sitting, freed from his space suit, in the comfortable cabin in the usual light clothing which they wore in the ship.

"That was a narrow escape!" remarked the engineer.

"But it was after all a marvelous experience, which I should not have wanted to miss, now that I am safely past it."

"What are all the sensations on earth, which the millionaires chase after, compared with this struggle with a comet?" commented Inge and clung close to her husband, whom she looked at proudly.

"I did not worry about myself," added the doctor, "when I saw that I was merely wedged in. I even felt comfortable down there. It was simply unpleasant that communication with you was interrupted and that I did not know whether you were still alive and would come to liberate me."

CHAPTER V

The Return

BUT the adventure with the comet unfortunately had an unpleasant consequence. Part of the fuel had been exhausted, equivalent in propulsion power to at least 1300 meters a second. Then two combustion chambers were damaged and could not be repaired without the utmost difficulty, while two others on the opposite side could not be run, to maintain symmetrical propulsion. But all this did not matter too much—merely the maximum acceleration was reduced from 60 meters a second to about 40.

One could still attain any final velocity, only it would take somewhat longer and therefore consume more fuel. This was the disastrous feature of the otherwise successful escape from the collision with the comet. In passing between the nuclei of the comet and turning out of the tail 3000 met-

ers a second of propulsion power had been consumed. The remainder would just have sufficed to bring the velocity of the space ship, which theoretically was to amount to 20 kilometers a second on cutting the orbit of Mars, to the 24 kilometers a second possessed by Mars itself.

Now there was also the disturbance of their course because of their detour, which would have to be corrected again. Thus, hard as it was, they had to give up the idea of visiting Mars this time and landing on it, and simply to pass by it at a distance of 500,000 kilometers.

"At the same time we have fortune in our misfortune, and not a little of it," explained the engineer, when he looked up again from his calculations for the first time in two hours. "The comet has cast us exactly into a course that when crossing the earth's orbit we shall meet the earth itself. And in fact we shall reach it from behind at an angle of only about two degrees, a favorable state of affairs, because then we shall approach with a difference in velocity of only about four kilometers a second.

"To be sure, its gravitation will impart to us a free fall velocity of 11,100 meters a second, by the time we enter the atmosphere. But if we succeed, at the last moment, in gliding tangentially to the earth, so that the top of the hyperbola in which we arrive is some 170 to 200 kilometers above sea level, in thin strata of air which will allow braking, then we can undertake the actual landing as though we had simply returned from a flight to the moon with a perfectly intact ship."

The doctor rose and shook his friend's hand. "Fellow, if you do that whole thing just as well as you did the landing on the moon, then you deserve to be given the 'Order of Comets of the First Class'."

Inge laughingly agreed.

* * *

Of course there was no longer a possibility of a visit to the planet Venus, which had originally been planned on the return trip from Mars. It had been calculated originally however, that such a visit would require neither the time for a considerable detour nor much expenditure of fuel.

They had passed Mars only in a wide arc and at this distance had not been able to solve its mystery. There seemed to be only one result of the observations, namely that the colors which Mars shows in the telescopes of terrestrial observatories do not belong to the ground itself as much as they are the result of absorptions in the Martian atmosphere.

"Probably the white places are the highest cloudlike formations, the greenish grey the ones in the middle, and the brick-red ones the lowest. These last are perhaps really white or grey, but since only the reddish yellow sunlight penetrates so far down, because the Martian air does not admit the other rays, only these can be reflected again."

This was the doctor's opinion. But he in no way insisted on this novel theory and was frank in admitting its uncertainty.

Two hundred and sixty days after the second cutting of the orbit of Mars, on the inward side, the space ship was again nearing the earth. It was high time indeed, for now the supplies of air and food were gradually running low.

Since there was no longer need of the machinery of the little power plant which had rendered such good service on the moon, they just threw them overboard, as they formerly had thrown all used up things and refuse out into space. Thanks to the force of ejection, they had soon gone out of sight of the ship.

THEY also resolved to abandon the great silver mirror, though not without first trying to send Morse signals to the earth with it, to tell of their impending arrival. This was done from a distance of 800,000 kilometers, the mirror being stretched out in space beside the ship.

"We must free the ship of every possible kilogram of needless weight," insisted the engineer in the decisive conference, in which they took counsel regarding the landing maneuvers. "Our supply of fuel is so scanty that it is just enough for the necessary braking of our tremendous speed, for otherwise we should run into the earth from

behind, like a racing auto into a load of hay.

"It really would not hurt the earth. 'See there, a splendid meteor!' the people would perhaps shout, when our ship in its steep course shot into the atmosphere and then of course burned up because of the enormous friction, if the pressure had not already crushed us to death."

Toward the end of the next watch, when the engineer was sleeping, to get some rest for the last time before the landing maneuvers, Inge, who was the lookout, noticed that at the place on the night side of the earth where Berlin was located a dim dot of light kept flashing and disappearing. She called the doctor, who was at the controls. He did not look through the telescope long before he said, "Those are Morse signals. They are flashing something to us. Note the long and short signals carefully."

And that is actually what it was. Berlin was signalling. "We have observed and understood your light signals with the great plane mirror. We have united 400 searchlights on the Tempelhof field, pointed them toward you, and are now giving signals by simultaneously switching on and off all these million-candlepower searchlights. As soon as we go out of sight, another metropolis which is favorably located will begin. We are flashing this message every half hour, until you give us a signal that you have understood. Then we will communicate directly back and forth."

This was too important to pass over. Inge awakened her husband, whose time for sleep was nearly finished. With quick decision he directed the three little searchlights, which the ship still had after the loss of the great mirror, toward the earth and switched on the current. Even though they had to be sparing of light, there was enough for a few minutes.

And then he sent the reply to the earth. In less than five minutes there came from Paris, which in the meanwhile had also entered the night side of the earth, the first signal that they had been understood. Since clouds were forming over Berlin, which made the sending of other signals impossi-

ble, Berlin had its greeting to the space ship transmitted by London.

The engineer flashed back, "In less than three hours we shall land in the Atlantic Ocean at about the latitude of 45 to 50 degrees. Notify all ships by radio, since it is possible that at the last moment something will prevent a good landing, especially as the machinery is damaged and the fuel very low. We still have air to breathe, our diving suits in order, parachutes ready, and everybody on board all right." With that he ended his message.

For the last time the bold travellers of space made ready for landing. Each had put on his space suit and his own parachute. Then the engineer stepped on the starter.

The rockets began to work as before, only four of them were still shut off. The steering gyroscope hummed and turned the exhaust end of the ship toward the earth. Now the engineer gave it the gas. Again streams of fire spat from the exhausts. The course was reduced from a hyperbolic to a parabolic and finally to an elliptic. This was nothing new, so long as one was still outside the atmosphere. But when the ship had already reached the height of 400 kilometers above sea level, and shot toward the earth in a very much flattened tangential ellipse, the first signs of air resistance made themselves evident, 160 kilometers up, for the nose of the ship grew perceptibly warmer.

"We must put out the braking disks, doctor!" called the engineer.

As viewed from the outside, there now came from the nose of the ship (which was pointed backward) a cable, on which there were arranged at certain distances thin metal disks, which were bent somewhat backward like cones, the result looking like the familiar tufts on the tail of a child's toy kite. One after another these disks glowed brightly and were worn away and burned by air resistance and the resulting heat, along with their cable, which burned like a candle wick.

But new disks kept coming out on more cable. In this way it was possible to convert the tremendous force latent in the mo-

tion of the ship into air whirls and heat in a gradual fashion, and by sacrificing the metal disks the ship itself was saved from burning. Besides this, the ship was working the exhausts in the reverse direction, as long as the fuel held out.

Finally the so-called orbital velocity of 7800 meters a second was passed in their retarding, and thus the danger was eliminated that they would again be lost in space. The effect was that of a bicycle wheel which gradually loses its impetus against the pavement of the street, when the cyclist has ceased to pedal. Thus the horizontal velocity decreased more and more, at last very quickly, too quickly!

If the ship had possessed extensible wings, like those of an airplane, a glide landing would have been possible. If there had been sufficient fuel, the engineer could have let it shoot down toward the sea in a vertical plunge, finally checking it much more easily and surely than on the airless moon. But neither of the two possibilities existed here. The ship was in any event lost. Perhaps the occupants could be saved.

The engineer called a last command through the wire. Then Inge and the doctor came to him into the actual control room, each still provided with a special parachute. Then by pressing a spring he closed the entrance and by another lever made the nose

of the ship open up. At the same moment the strong counter-current of air pulled out the great parachute and with it the control chamber, which now proved to be a 'life-buoy'. The ship itself dived down.

The great parachute indeed moderated the descent from several thousand to a few hundred meters a second, but in the long run it was unequal to the evolution of heat and caught fire. Now there was only one recourse for rescue, to burst the chamber and jump out to seek safety, each on his own little parachute. This too was all ready, and a second later the three people were floating down to the earth on white parachutes, which stood out against the sky like shrapnel clouds. This time the ropes held and the parachutes proved adequate, until the sea received the bold travellers of space and rocked them on its waves until a swift seaplane arrived to take them aboard.

The slender sinewy man who was the first to leap into the water, who swam to Inge and aided her to unscrew the diving helmet, was none other than Tom Sacket, chief correspondent of the *Globe*. Five seconds later, there in his bathing suit, he had already got out his pad of paper and begun the interview. And in ten more minutes the radio of the hydroplane, now soaring up with roaring motors, was sending the first news to his paper.

THE END.

The Time Projector

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thunderbolt. Copies of it were waved about in the national congress as a sign that the world was going to the dogs. A delegation of business men visited Carol and threatened to withdraw all advertising support from his paper. He received hundreds of letters of praise and threats—some letters barely legible, others indicating that the sender was a person of wealth and culture. A plot to bomb his building was discovered, on the day that Booth again began the aggressive broadcast of the cloud pictures.

Through two days of stormy debate in the national congress the bill was the subject of all attention and even the cloud pictures

were forgotten momentarily. And on the day that the bill passed and the President signed it, twenty-five congressmen picked up their hats and walked from the halls, they said, "never to return," leaving their former colleagues with an uneasy foreboding silence.

That night there was rioting in a dozen American cities, in South America and in European nations where bills similar to the American act were before the national congresses. The morning papers reported in America alone, three hundred men and women arrested and imprisoned under the new "Defense of Property Act." Mobs storm-