GIANT AND DWARF STARS By SIR JAMES JEANS

THRILLING WONDER STORIES

FEB.

15¢

A THRILLING PUBLICATION

LIFE ETERNAL
A Novelette of Solar Secrets
By EANDO BINDER

DREAM-DUST FROM MARS
A Novelette of The Future
By MANLY WADE WELLMAN

•

ZONES OF SPACE
A Novelette of the Sunken World
By MAX C. SHERIDAN

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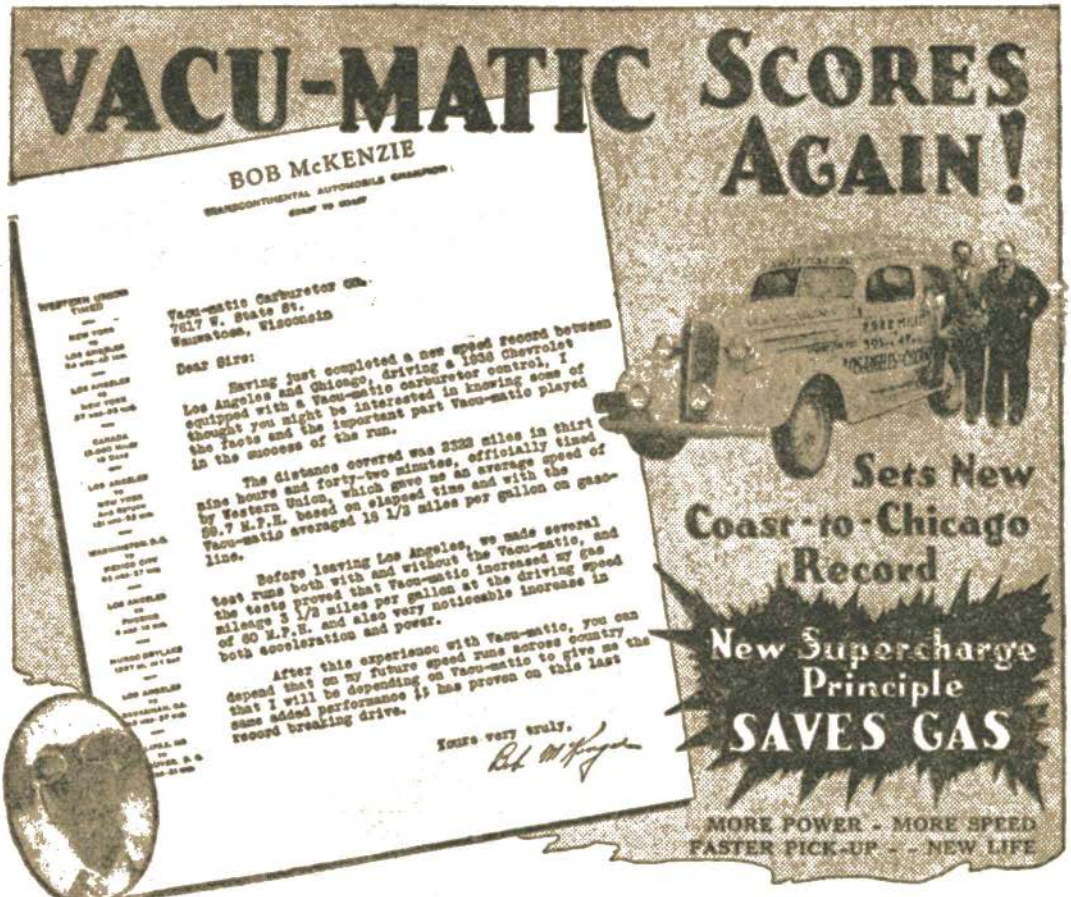

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VACU-MATIC is constructed of six parts, assembled and fused into one unit, correctly adjusted and *sealed at the factory*. Nothing to regulate. Easily attached in ten minutes.

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VACU-MATIC must prove itself on every car. It is guaranteed to give worthwhile gas savings, quicker pick-up and more power, or it costs you nothing. "On my V-8 Ford it works miracles", says Ralph Fields. James Seeley—"On an International Truck on a round trip to Cleveland, 385 miles, it saved 19 gallons of gas." A. V. Grove—"On the Buick it showed 5 miles more per gallon." F. S. Peck—"I average 22 miles per gal. on my Plymouth, an increase of 7 miles, for a saving of $15.00 a month, or $180.00 a year." Wm. Lyons—"Averaged 25 miles on a gal. with a Model A Ford at 40 miles per hour."

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THRILLING WONDER STORIES

The Magazine of Prophetic Fiction

VOL. 11 NO. 1

February, 1938

IN THE NEXT ISSUE

THE INFINITE ENEMY
A Novelette of a Lost Universe
By JACK WILLIAMSON

HOLLYWOOD ON THE MOON
A Novelette of Tomorrow's Movies
By HENRY KUTTNER

THE DARK AGE
A Future Science Story
By CLARK ASHTON SMITH

A SPECIAL ARTICLE ON ECLIPSES
By SIR ARTHUR S. EDDINGTON

—Plus many other unusual novelettes, stories and features.

● EVERY STORY BRAND-NEW

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● ON THE COVER

Anton York, the immortal scientist, is irrigating the canals of Mars by melting the ice-capped pole of the planet with his heat ray. This painting depicts a scene in Eando Binder's novelette, LIFE ETERNAL.

Published bi-monthly by BETTER PUBLICATIONS, INC., 22 West 48th Street, New York, N. Y. N. L. Pines, President. Copyright, 1937, by Better Publications, Inc. Yearly $.90; single copies, $.15; Foreign and Canadian, postage extra. Entered as second-class matter May 21, 1936, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Names of all characters used in stories and semi-fiction articles are fictitious. If a name of any living person or existing institution is used, it is a coincidence.

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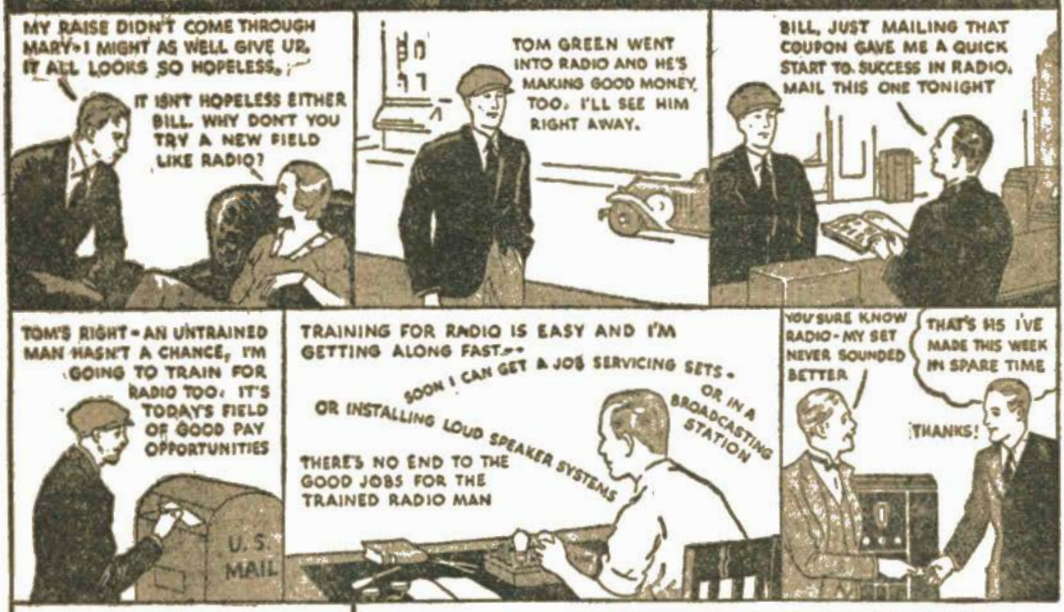
HE THOUGHT HE WAS LICKED-THEN A TIP GOT BILL A GOOD JOB!



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National Radio Institute, Washington, D. C.

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ADDRESS.....

CITY.....STATE.....

The Story Behind the Story

SUPPOSE you were an astronomer, scanning the heavens nightly, charting the stars in their courses—when suddenly you discovered a dazzling new star—a star radiant and pulsating with life. Discovering that new star would be the thrill of a lifetime. And rightly so.

That's exactly the feeling we had when we came across the manuscript of ZONES OF SPACE among a pile of science fiction yarns three feet high. The list of contributors to THRILLING WONDER STORIES reads like a Who's Who of Science Fiction—Eando Binder, Arthur L. Zagat, John W. Campbell, Jr., Ralph Milne Farley, Paul Ernst, Arthur K. Barnes, Edmond Hamilton, John Russell Fearn—the list is a long one. But along comes Mr. Sheridan with his story of the challenge of Atlantis, and all the stars in our galaxy are outdazzled.

FUNDAMENTAL LAWS OF THE UNIVERSE

ZONES OF SPACE hits us as one of the best pseudo-scientific stories of the year, with a theme that is new and stimulating. We think the old-timers will have a long way to go before they can equal the magnitude of our new-found star. At any rate, tell us if the story comes up to your expectations. And here's a note from the author on what it's all about:

My "Story Behind the Story" for ZONES OF SPACE will undoubtedly clinch the argument that anyone who writes fiction must have been dropped on his head before he'd much more than had a chance to begin a sane and normal life. But so be it; let the consequences fall on the same soft spot.

Once upon a time I ran across a profound epigram—don't ask me where, because I don't know—that "Morality is a white bathing suit in New York City; Immorality is a white bathing suit in Atlantic City"—or maybe it was the other way around. At any rate, you get the idea: What is perfectly respectable and proper in one section of the country, may be entirely improper, or even illegal, in another.

Quite a far cry to a science fiction story yet, isn't it? Well, here's the way the wheels went around: If the same condition were right in one section, but wrong in another, it wasn't the condition that was to blame, but the standards of the different sections. Pursuing the thing to its ultimate: If a standard or law can vary from city to city, state to state, country to country, is there any reason why space itself may not be allowed its whims and variations as well as every other physical and psychological manifestation with which we are familiar?

I couldn't find any.

I believe it is too often the failing of our scientists to assign an homogenous composition to anything with which they are not entirely familiar. Remember how several hundred years ago, a speck of dust was the limit of the infinitesmal? Then some blunderer came long and discovered the microscope, and disproved all their carefully constructed theories. Then the atom was the absolute limit of smallness. Again a busybody had to pull down their playhouse.

Until fairly recently, water was water, whether you drank it or preferred it only for bathing. Our chemists dignified it by the cryptic term "Di-hydrogen oxide," or "H_2O." Which all b ings to mind a little poem I heard many years ago:

"Willie was a chemist,—but Willie is no more, for what he thought was H_2O—was H_2SO_4."

It seems that Willie must have been one of those people who actually drank water, so it doesn't seem so strange after all that the sulphuric acid overtaxed his enfeebled digestive system. But to struggle back to the point in question—water is no longer just water; it may be light water or heavy water. And heavy water is supposed to bring about strange things in the metabolism of living things.

So—if there are zones of various kinds on Earth, whether they be parking zones, safety zones, or fire zones, whe e the fundamental laws and bases for procedure are entirely different, is there any reason why space too, should not have its zones?

And there's where the fun began. If space is not homogenous, but has zones wherein different laws hold true, then Earth, with its Sun and the rest of the Solar System, must be in one particular zone at the present time. So—everything works out according to Hoyle. But! What would happen if our System trave sed the limits of our particular zone, and penetrated the edge of a new one?

Do you know? I didn't either—so Neil Danson and his pal, Bert Baker, worked he whole thing out for me, with the aid of their friends, Larsen and Donovan. You see, Neil and Bert, and their two friends are very real to me. They did the work; endured the hardships. I was only their—sponsor.

And there you have it—from Morality to ZONES OF SPACE.

IMMORTALS OF SPACE

ANTON YORK, the immortal hero of EANDO BINDER'S novelette, LIFE ETERNAL, had the power to remake the entire Solar System, planet by planet, and moon by moon—and the time of a dozen centuries in which to do it. The secret of immortality, with which Anton York and his wife were gifted can be either a blessing or a curse. More difficult still it was for Anton York to decide whether humanity should receive the endowment of eternal life. All in all, these are swell elements for a dramatic sc ence fiction story, as the author's letter here indicates:

Writing a sequel is not quite the same as starting out fresh on a new idea. Here I had certain developments from the first story that made a rigid framework around which the second story had to be written.

But I did have an idea in mind for some time which I decided to work in here—the idea of rearranging the Solar System somewhat for mankind's benefit. There is a truism that if man cannot change his environment, he must adapt to it. Something like Mohammed and the mountain, too. Anyway, it struck me that a person like Anton York, immortal and almost godlike in his mental powers, would be the one to accomplish such a gargantuan program of "redecorating" in the Solar System.

And what a job it turned out to be, for him and me both! One thing led to another. I had at first only thought of giving Venus a moon, and touching up the canals of Mars and pricking the bubble of poisonous gases that made up Jupiter's Red Spot. But before York—and I—got through, we had just about cleaned up everything in sight.

(Continued on Page 127)

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I've got a quick easy way to train you in the money making field of Electricity. I'll take you here in my shops for a 12 weeks' training on real actual Electrical machinery and equipment which will prepare you for your start to a better job and a real future. Of course, all the training in the world couldn't help you if it was out of your reach. Well, because I know this I've made it possible for you to get this training even if you haven't a lot of money. Send t e Coupon today and I'll not only tell you about my training but I'll tell you how you can get it first and pay for it later. Get training first—then start paying for it in easy monthly payments starting 60 days after your regular 12 weeks' training period is over.

Look at this picture and you will understand how my students learn quickly by my "Learn By Doing" method of training on actual equipment.

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Have International Junior Stamp Album, 1927 issue, in good condition. Also camera in good condition. Want printing press cuts, tapier, or what have you? Alan Gol , 1170 E. 8th Street, Brooklyn, New York.

What will you offer for Texas nature specimens and minerals? Can get lizards, insects, cactus, anything. Have hematite, calcite rocks, etc. Clifton Morris, 1946 19th Street, Lubbock, Texas.

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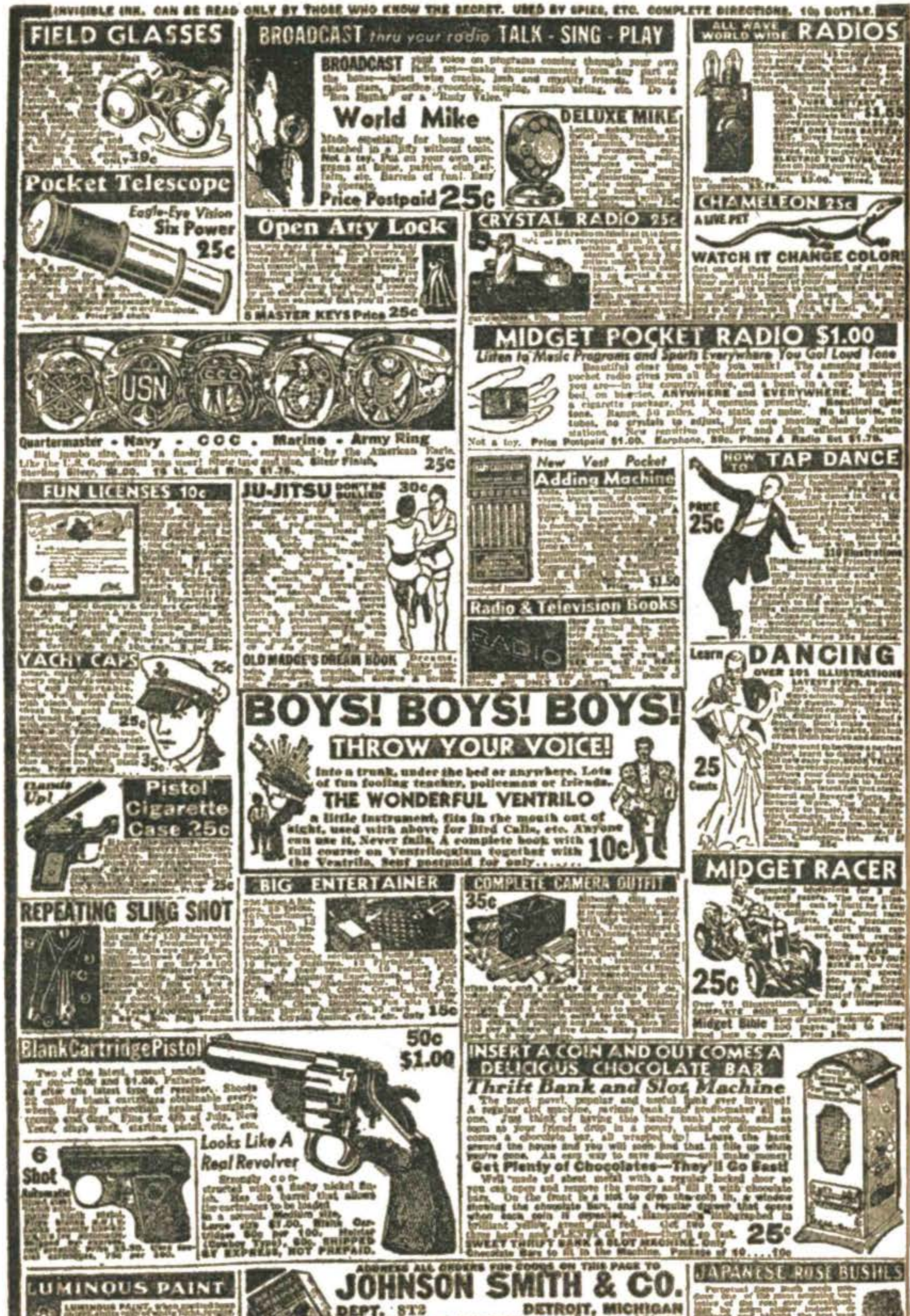
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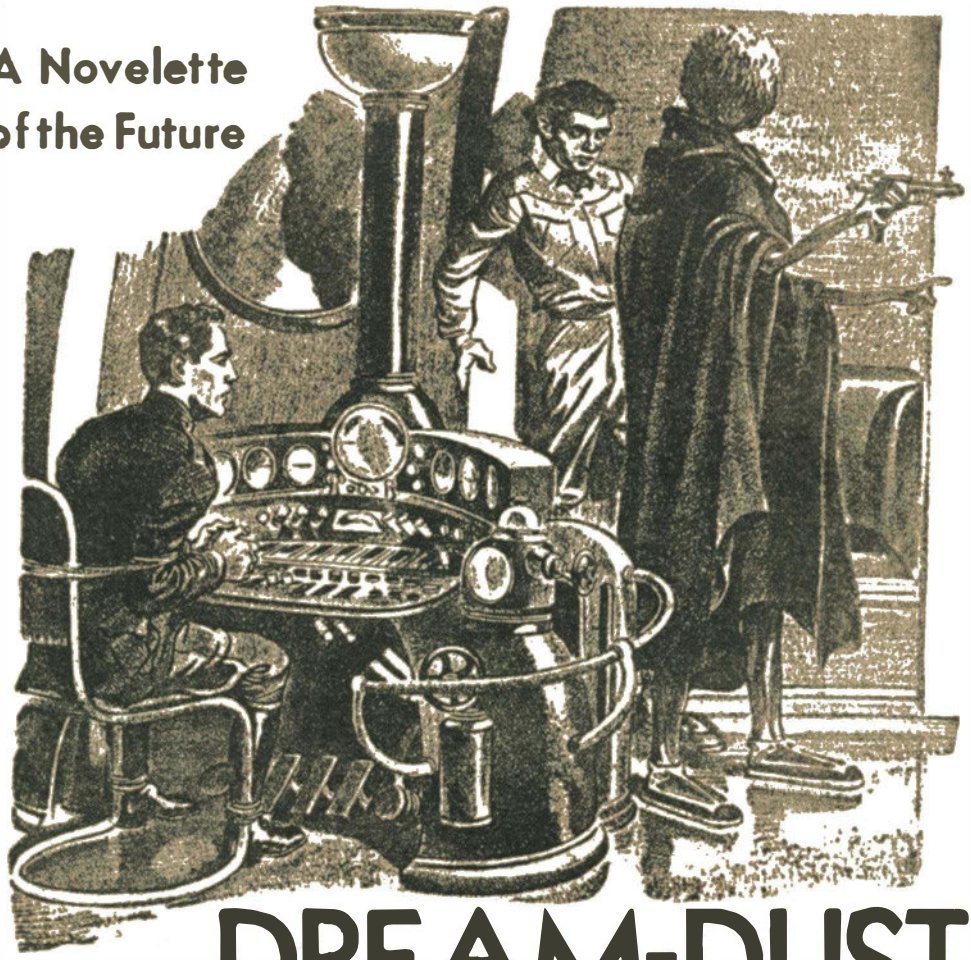

DREAM-DUST

CHAPTER I

The Martian Traveler

THE Cairo Rocket Field of Spaceways, Inc., was a great pool-like disk of blast-pitted metal among the dunes six miles from Egypt's capital.

Around its brink were ranged tool sheds, hangars, and offices, interspersed with clusters of palms and carefully tended lawns and beautiful flower beds.

Just now the only craft in sight was Stratocar No. 2, poised ready in its collar of girders like a big dural egg in an openwork cup. In six minutes it would be noon, and Stratocar No. 1 would drop down from the clouds at the end of its own twenty-four-hour whirl around Earth. Five minutes to switch baggage and passengers, and then No. 2 would rise and proceed in turn.

Young Glenn Warwick, Stratoman First Class, emerged from the pilots'

Glenn Warwick Knew Only One Service

Threatening Its Dwellers With Oblivion!

"Blast us both, then," she dared Xaol

FROM MARS

By MANLY WADE WELLMAN

Author of "The Disc-Men of Jupiter," etc.

dressing shack. Giving a final tug to the skirt of his neat tunic, he strode toward the stratocar. His polished boots rang dully on the hot metal of the field. His pale, clear eyes narrowed into a frown and his jaw, naturally salient even in repose, tensed and thrust forward like the point of a pickax. He hated his job.

And why not hate it, he was musing savagely. What was stratocar service? An outworn formality, no more. Fifty years ago, when Spaceways, Inc., was awarded the interplanetary transportation monopoly by the Martio-Terrestrial League, there had been a certain condition in the franchise:

> The corporation further agrees to maintain a twenty-four-hour service around Earth, at or about the t irtieth parallel of latitude. . . .

When that condition was imposed, the stratocar was the last gasp in short-jump rocket transport. It was designed to rise like an elevator into the

Motto—Stratocars Follow the Sun!

thin upper reaches, then to sail westward at a rate approximating a thousand miles an hour, the sun ever above it.

But decades had slid along, bringing newer, faster devices. And the franchise said "twenty-four-hour service." Wherefore these old strato-crates maintained their daily crawl around the thirtieth parallel, that Spaceways might fulfill the last idiotic demand of its agreement, and a rising generation of satirists enjoy a joke.

HE, Glenn Warwick, was part of that joke. He resented the thought as he reached the ship, mounted the metal gangway and opened the lock panel. The polished inner surface of the out-swinging rectangle of metal flashed back his image. Tall, spare, resolute-looking and even handsome in his neat uniform, he had the ready port and the alert, strong-featured face of the intelligent man of action. The born space-wrangler.

Why wasn't he out in the airless lanes between Mars and Earth, or beyond on the adventuresome way to the Jovian colonies? Not that he hadn't tried.

"You're only twenty-four—young, Warwick," his immediate superior had said genially in refusing his last petition for a rerating.

Young! But this was an old man's job he was doing now, a routine chore for some gaffer who, reflexes slowed down and fires quenched by long, sapping service between the worlds, would be willing to take a soft and unexciting billet.

Entering the cabin, Warwick glared with undiminished hostility at the view from the ports, at the worn upholstery of the comfortable chairs, at the banal service motto in its frame against a bulkhead:

STRATOCARS FOLLOW THE SUN

Once, four interminable years ago, he had seen those words at the top of his brand-new pilot's certificate. He had thought them inspiring. He smiled bitterly. What a chump he'd been!

Four years of swinging stupidly around the custom-worn path, of seeing the same circular cabin thirty feet across, the same curved bulkheads, the same domed ceiling, the same instrument panels. He hadn't even experienced the saving novelty of an emergency that would call for spaceman-ship, tinkering or sending of an appeal for help!

In the center of the floor was the operator's seat, flanked by the control board and the instruments. Sitting down, he checked the controls with the almost automatic rapidity of long practice. They were all working properly, were almost too simple, at that, to get out of order.

Then a glance at the service sheet. Three passengers to transfer from No. 1, and a single fare boarding here. Probably drab, timid souls who stuck to this time-honored conveyance because they feared the dash of the newer whip-rockets that outran the sun to the tune of two thousand miles an hour.

"I might as well take dream-dust!" grumbled Warwick aloud, and for a moment he actually meant it.

A little more than a hundred years before, in the early twenty-seven-hundreds, Martian traders had fetched to Earth that strange lichen-spore drug that is gathered on the tiny satellite Phobos. Upon Mars it was considered an agreeable stimulant, dangerous only if swallowed in great quantities. But three terrestrial experimenters, taking tiny portions, fell into sudden trances. And it was a full century before they awakened.

Warwick had read the accounts, heard the newscasts, of that awakening. It had been only five years ago. And what a tale the sleepers had had to tell—of a century of ravishing dreams, each achieving in his fancy the delights he had most longed for and most lacked. It had been a vision of heaven itself, one claimed, and all he desired was another dose and another trance.

A SECOND waker, equally joyous to find his old debts outlawed, his shrewish wife long dead, his record

clean, greeted with enthusiasm a more advanced, more intriguing world than the one upon which he had closed his eyes. The third had little to say, but hurried to buy up a supply of the dream-dust so that he might profit by the demand he foresaw.

It became popular at once. Everybody began to take it—the defaulting banker, the heart-broken lover, the disappointed visionary, the cynical philosopher, the out-and-out seeker of new and pleasurable experience. A century of radiant dreams beckoned, with adventures in an unknown future to follow.

In vain did the Terrestrial Council condemn the pollen, declare its unconscious victims legally dead, preach, threaten, plead. More took it, and more, until it began to seem that all Earth would drug itself to slumber and none be left awake to care for the silent throngs of sleepers in the glassed-in hospital wards.

At last the dust was outlawed and a penalty of long imprisonment visited upon its sellers. Yet it came to Earth in bootlegged consignments. Warwick knew that. It could be obtained. . . .

But he put the idea from him even as he toyed with it. What though he took dream-dust? He would only wake up at length and he would still be young and unapproved. No, he'd stick out his apprenticeship, hoping for the break to come, the chance to show his qualifications for the work he most desired.

Sighing, he glanced through the open panel-way. His first passenger was entering.

In after years Warwick was always to think of her as he first saw her, to experience again his first dazzling impression of the most thrilling human being he had ever known.

She was a little younger than he, with the supple slenderness of youth. Her ample scarlet cape was flung loosely open, revealing the silken sheath of burning blue that hugged the slight but gracious rondures of her patrician body. Her thunder-dark hair, bound at the brows by a jeweled fillet, was caught and puffed into opulent masses at either side to set off the delicate contour of her blush-ivory face. Eyes like ink-pools regarded Warwick closely, then slanted in friendly fashion, while her crimson lunette of a mouth deepened its curve in a smile.

"I am Isis Kentu," she informed him, in a hushed voice that yet filled the cabin with music. "Here's my transport voucher."

Warwick took it from her long fingers. Isis, he remembered, had been a goddess of long ago—as this girl was a goddess! And Kentu was a famous name. Yes, the voucher told him. Princess Isis—Princess!—daughter of Prince Seti Kentu, of Egypt's royalty and (golly!) the majority stockholder of Spaceways, Inc.! The attached photo of her failed to do half justice. Across it was written:

Employees will show the bearer of this voucher every possible courtesy.

As if Warwick needed such bidding! He bowed stiffly, feeling her midnight eyes still upon him.

"Princess Isis may command me," he said formally.

"Thanks." Her warm smile made her face even more radiant as she sought a chair.

HERE came the others. In the sudden excitement of greeting this regal beauty, Warwick had not even heard the muffled descent-blast of Stratocar No. 1.

Two of his passengers looked alike as they entered and offered their vouchers; they were darkly cloaked and cowled as if against the chill of the stratosphere. Warwick could not see their faces, but by their hunched backs and slow feet he judged them to be elderly terrestrials. Many such used stratocar service in preference to swifter, newer transport.

The third and final passenger to board the craft was a Martian. After the fashion of so many of his adaptable race, he had prepared himself artificially for life among terrestrials. That meant that two of his lower tentacles had been scientifically strengthened and enlarged (Martian surgeons were wonders at that) to stand upon their

thick, round tips like proper legs.

The body above them, in its natural state a squashy bladder, was held upright by a clever harness and a spine-like support of jointed metal. And upon its cleverly shaped shoulders rested the bizarre cranium that was the strangest feature of the Martian physique—a round football completely covered with sensitive tongues of tissue, like petals of a pinkish chrysanthemum.

Like the other three transfers from No. 1, this strange being wore a long dark cloak. Its wide sleeves almost hid from view the two sinuous tentacles that served for arms. The normal Martian had four more appendages, but in most cases these were atrophied or even amputated, the more accurately to approximate terrestrial form.

The passenger offered Warwick his voucher, and the fronds upon his blossom-face seemed particularly alert. It was as if he were concentrating upon the strateman all of his strange awareness that did duty for the whole five of the terrestrial senses.

"Xaol, No. 777924-XVGM." His passport number, of course. And his photograph, grotesque thing, tallied. But where had Warwick heard in the past of Xaol, No. 777924-XVGM?

"You feel that you recognize my name," rose the stilted purr of the Martian's voice, shaped into terrestrial words by an artificial larynx set in the air passage among the petals of Xaol's face.

"Yes, I thought I did," said Warwick casually. "I can't remember where."

He handed the paper back. A slender tentacle tip accepted it and stowed it away in some recess within the robe.

"Ah," sighed Xaol. "I did receive some unfortunate publicity a few months ago. The newscasts were libelous, my friend. Libelous in the extreme." Scorn crept into the monotonous flow of words. "A matter of fantastic accusations, concerning the illegal dream-dust traffic."

"I remember." Warwick nodded, trying to be tactful. "And there were retractions, weren't there? Didn't the charges fall down?"

"Fall down? Oh, yes!" Xaol gurgled in his false throat, achieving something like a soft laugh. It was hardly a pleasant sound. "They fell down rather awkwardly and ridiculously. Insufficient evidence, you understand."

"Congratulations," muttered Warwick, who was embarrassed by the Martian's evident relish of the discussion.

"Insufficient evidence," repeated Xaol, almost cooing the words. "A verdict that covers a multitude of mistakes."

He bowed, glided across the floor, and took a chair next to Princess Isis Kentu.

Glad to see him go, Warwick closed and fastened the panel, then sat down at the controls in the center. The chronometer ticked off the last half seconds as he watched. A touch of his fingers upon the keyboard, and the vessel vibrated like a gong.

CHAPTER II

Startling Proposal

PRINCESS ISIS KENTU, glancing from the port, gave a little cry of satisfaction or excitement as the journey began. Below them the rocket station dropped away; the desert and the parti-colored diagram of the city beyond. Warwick fingered the accelerators. The floor pressed hard against their soles. Clouds slid past the ports, more clouds, then clear light that rained from a dark sky. Warwick struck a final combination of keys.

There was a surging tremor as the ship turned its nose from perpendicular to horizontal. The cylindrical cabin kept its upright position, turning on a pivot within the egg-shaped outer shell. Warwick threw a lever to lock the craft upon its course, and rose.

"In seven hours and forty minutes we land at Jacksonville," he announced, as regulations demanded.

Now would come hours of idleness as the ship skimmed along the course

to which he had set it; hours generally spent by some bore in chattering to Warwick. But neither of the two cloaked passengers stirred, and Warwick turned gratefully toward the Princess Isis. An opportunity to talk to her, now.

But she was already engaged; occupied, fascinated even, by the artificial, purring voice of Xaol beside her. Warwick felt a trifle piqued, even while acknowledging to himself that she owed him no attention. Yet she had been cordial, bewitchingly so; and he, Warwick, would not have been human had he not been attracted. What did she see in that walking chrysanthemum from another planet? The stratoman shrugged and sank back into the central chair among the instruments.

At once the murmur of voices was audible. He remembered that the freak acoustics of No. 2's cabin reflected all sounds from the curved bulkheads back to this central point. For a moment he felt embarrassed. He balked at eavesdropping on Princess Isis Kentu, even thus involuntarily.

"But it's so important to me!" she was pleading to Xaol.

The Martian hummed a moment in his strange throat, then replied:

"It is important to me, too, in that it concerns my safety. Terrestrial judges are harsh on traffickers in the dust."

Warwick almost sprang erect. Dust! Did Xaol mean dream-dust? He listened eagerly now. The princess spoke again.

"If I guarantee your reward and your safety?"

"That," murmured Xaol, nodding his fronded skull, "might interest me. After all, I agreed to meet you aboard here and talk business. How much do you want, and what will you pay?"

Just then a fuel gauge dial began to tick loudly its message of faulty mixture. Warwick hurriedly adjusted levers for correction of the inadequacy, and when he was through again cocked an ear in time to hear Xaol protest gently:

"Dear Princess, you want too much. My supply is limited."

"I must have the dust, and plenty of it," she admitted.

Warwick scowled. Admire a beautiful woman, he told himself, and Fate immediately revealed her as unfit for admiration. Yet he was mystified beyond all his previous experience. The Princess Isis was lovely, distinguished, of one of Earth's wealthiest and proudest families. Why should she mix into the unlawful, sinister dream-dust traffic? Why did she demand so much of the drug that even a dealer expressed surprise.

"I MUST have the dust, and plenty of it." Was she a jaded sophisticate seeking excitement in battling the law? Did she intend to sell the drug retail? Was she buying a supply for a group that meant to sleep for a century, herself with it? Despite his mounting disapproval of her, he hated to think of that glorious body lying silent for a hundred years when it might move and live and delight the eyes and souls of a world.

"Very well," Xaol was agreeing at last. "However inconvenient and dangerous, your terms tempt me. I shall get the dust in Jacksonville."

"Thank you," breathed the princess, almost humbly.

Warwick rechecked his gauges with unnece ary care and rose again. He had no desire to hear more. The two had convicted themselves of one of the most serious crimes on the terrestrial docket. He must expose them.

But a new problem suddenly perplexed him. How would such exposure be regarded? Criminal though she might be, Princess Isis Kentu was the daughter of Spaceways' chief stockholder, and he, Warwick, was a lesser employee. In causing trouble for her, what about himself?

He cursed under his breath. He had been asking himself unanswerable questions ever since Stratocar No. 2 had taken off at Cairo, and every question had concerned this blazing, mysterious Egyptian beauty. Never before had a woman so occupied his attention on so short acquaintance. He strode moodily to a port and gazed out.

Clouds far below, so distant that

they seemed silken, formed a layer that shut out sight of Earth. Above the car was the blue-black sky, around it the undiluted sunlight. Minutes passed as Warwick studied the scene. He found some comfort in the immensity and emptiness of the stratosphere they plied.

His own troubles seemed trivial by comparison.

Someone touched his shoulder. Half startled, he whirled to confront the princess.

She seemed fully as confused as he. Her red lips trembled as she spoke.

"Skipper, if you please—" Then she paused.

"My name is Glenn Warwick," he supplied.

"Skipper Warwick." She glanced around to be sure that the other passengers did not hear. "You heard what Xaol, that Martian, and I were saying."

"Princess!" he protested.

"Not so loud, please. I know you heard. You are justified in believing the worst of me. Yet you mustn't."

He felt profoundly uncomfortable and must have shown it, for she smiled sympathetically.

"If I give you my solemn word, Glenn Warwick, that I am engaged in an honorable venture, will you please believe me?"

He tried to look grim, but it was no use. Her charm was entirely too much for him.

"I'm afraid that I'll have too."

"Thank you." She gazed at him in honest liking. "You're intelligent, Skipper, and fit for a better job than this."

"A better job!" he echoed eagerly. "Golly, to quit this crippling around in the stratocar service, and go into the interplanetary div—" It was his turn to break off. Again she smiled sympathetically.

"Perhaps your chance will come," she said, then returned to her seat beside Xaol.

This time she spoke to the Martian in a whisper. Warwick, back at his instruments, could hear nothing. Busily he wondered how big a fool she would make of him before they reached Jacksonville.

HOURS continued to wear on. Warwick hummed, pondered, twiddled his thumbs, wished at last that one of the cloaked passengers would engage him in trivial conversation. He was glad when the midpoint of the journey was passed. In another hour it would be tea-time, and he could occupy himself with passing out the refreshments that the stratocar service provided for its patrons. At least it would be something to do, and tea might seem companionable.

In the midst of his bored reverie, Xaol rose from his place beside the princess and approached.

"How soon shall we reach Jacksonville?" asked the Martian.

"In about three hours," Warwick informed him.

"And what time will it be?"

"Noon—Jacksonville time," replied the stratoman. "Of course, in Cairo, where we started, it will be past seven P. M."

"An interesting example of time's relativity," nodded Xaol. "We leave at noon, travel thousands of miles—and arrive at noon. Time has stood still. I daresay you have contemplated the situation."

Warwick had. Almost every passenger who spoke to him had some banal comment to make on the subject. However, he nodded politely in turn.

"And when we arrive at Jacksonville?" pursued his interrogator.

"We ground," Warwick explained, as so often to others. "The magneto-beacon draws us automatically into dock."

"Magnificent!" applauded Xaol.

"Automatic," supplemented Warwick.

"But if we landed elsewhere?"

"We wouldn't, except in emergency. We have equipment to set ourselves down." Warwick gestured toward the controls.

"Ah, so I see. Exactly like the descending mechanism of a whip-rocket."

"Exactly."

"I am familiar with whip-rockets," said Xaol enigmatically, and returned to his chair.

Tea-time arrived. Warwick announced it in a cheery voice and from a locker produced the sealed containers

of food and drink. He served Princess Isis first, then Xaol, then moved on to the nearest of the silent couple in cloaks.

A hand reached for the package—an immense hand, like a muscle-ridged spading fork, dusky yellow in color. Warwick started at the sight. From behind him came Xaol's chuckle.

"Ah, Skipper, the first glimpse of Ipsu's fist has often surprised one. Stand up, Ipsu, and you, Bula. Let him see you."

The robe-swathed figures obeyed. The one whom Warwick had been about to serve towered ominously as it threw off cowl and robe. A giant, with an immense chest, a head like a cask, arms as big as ordinary legs and a high-boned flat face with slant black eyes and a shock of jetty hair. An Eskimo. Again Xaol seemed to read Warwick's thoughts.

"My companions are native Greenlanders. If they have been uncompanionable until now, they shall make amends. Ipsu, Bula! Take charge of him!"

The huge Eskimo seized Warwick's shoulder in fingers like huge tongs. The smaller one, a catlike young man with a wickedly handsome face and dandified garments that were revealed as he cast off his cloak, stepped quickly to Warwick's other side.

The stratoman was young and strong, but he felt the futility of resistance. Subsiding between the two Eskimos, he watched Xaol, who had gone to the keyboard and was changing its combination with skilful tentacles. After a moment the ship writhed noticeably, changing course. The Martian clamped the controls anew.

"WE are heading north," he announced. "In Greenland we have a cozy, if isolated, retreat. I am glad that this antiquated craft may be maneuvered without ground magneto-motors. You, Skipper"—and he bowed toward Warwick—"are relieved from command."

The Stratoman was glaring at the Princess Isis who sat pale and tense upon her chair. Her eyes met his, full of fright. "I—I know nothing about this," she choked out miserably.

"No more you do," agreed Xaol. "I shall enlighten you. You asked me to meet you aboard this craft, as an ideal quiet place to bargain for dream-dust. You wanted a tremendous quantity, more than you could buy from an ordinary smuggler. Will you be surprised, my dear Princess, to learn that I know why you want it? A question of making a counter-agent, eh? And reviving your father from his sleep of a century?"

"You know!" she cried.

"Yes. For it is I who mingled the dream-dust, unknown to him, in his tobacco and coffee."

The Princess had sprung to her feet. "You dared! My father, the Prince Seti, who had all but perfected in his own private laboratory a concentrate that will awaken these foolish dust-sniffers! And you drugged him?"

"It is the beginning of a profitable program," replied Xaol, unabashed, "that now approaches a climax beyond my expectations. You yourself have fallen in with it by contacting me. Your father, thus asleep, will be reckoned dead—as soon as I warn the authorities of where he lies hidden. You, his daughter, will become heir to his controlling interest in Spaceways."

"Well?" she challenged boldly, and Warwick's chest swelled in admiration of her defiant manner. Ipsu tightened his grip.

"Patience, while I explain," Xaol said to her, his manner that of a teacher with a dull student. "You are unmarried, Princess. A husband should administer your holdings much better than you. My associate, Bula, is not considered bad-looking."

"Xaol, you don't mean—" Warwick cried out sharply.

"Oh, you have a part in it, Skipper. As operator of a craft, you can solemnize a provisional marriage. It is my desire that you here and now declare the Princess Kentu married to Bula."

Sudden and unreasoning rage possessed Warwick. With a heave and

struggle he tore himself away from Ipsu and bounded across the floor at Xaol.

CHAPTER III

Dream World

THE Martian dodged a swinging right that would have smashed his thin skull, hooting shrilly for help. The Eskimos swooped like hawks, throwing Warwick to the floor under and among the instrument stands. Princess Isis rushed in, but did not seem to help much.

There was a smash of glass and a tinkle of metal; something was broken. Xaol bent low above the three wrestlers, a pistol-shaped metal-solvent ray in his tentacle.

"Careful with him!" he warned. "He must perform that ceremony."

Warwick contrived to snap Bula's handsome head back with a smash to the chin, but then Ipsu had seized and doubled his arm painfully backward. Bula, recovering, helped subdue him. Together they forced the stratoman into the chair that was clamped to the floor among the instruments and bound him to it with cords that Xaol had produced from under his robe. His ankles they tied to the front legs of the chair, and knotted his wrists securely.

"What smashed?" asked Bula as he drew the coils tight.

"The compass," replied Xaol. "No matter. As we go northward we can navigate by observing familiar landmarks. Now shall we continue our tea? Pardon the interruption, Princess Isis."

She gave him a disdainful glare and sought a chair apart from him. Undismayed, the three new masters of the ship addressed themselves to the food. Ipsu ate the sandwiches in his own portion as well as those which the princess now scorned. Bula, though smaller, proved almost as hearty a feeder. Xaol produced a slender metal pipe through which he imbibed fruit juice from a container. Between sips he addressed his prisoners.

"I trust you understand, my friends, how little I was satisfied with the limited opportunities in the dust-smuggling career. When Bula has married the princess and, with the certifying of her father as legally dead, takes over the controlling interest in Spaceways, I expect to shine as his adviser. There is wealth, power, adventure in a career like that, eh?"

"You think the Martio-Terrestrial League will permit it?" demanded Warwick, tugging helplessly at his bonds.

"Should the League ever learn the truth, I can bring it to heel by paralyzing the transport system I control," returned Xaol. "Hmmm! I may do that, anyway, to show my power; prepare the ground for a greater adviserships, an adviserships to the League itself."

"You mean a dictatorship," snapped Princess Iris Kentu. "In the meantime, have you been successful even in the dream-dust business?"

"Oh, yes," sighed Xaol languidly. "Not only that, but I have perfected the counter-agent you are trying to make."

THE giant Ipsu snickered in applause of his chief, but the girl shook her head.

"I don't believe it," she snapped.

"But I have. You think I have not experimented? I can neutralize the effects, awaken the soundest sleeper. Still skeptical? We must convince you. We must demonstrate." He turned his facepetals toward Warwick.

The stratoman set his teeth. "You won't demonstrate on me."

Xaol chuckled metallically. "My poor Skipper, you cannot dictate." A tentacle groped in the recesses of his robe and brought forth an atomizerlike instrument of dull blue metal. "Ipsu, tilt his head back."

The big Eskimo slouched across, took up a position behind Warwick's chair and clutched the stratoman's head in his great hands. Warwick writhed angrily against the pressure. Princess Isis cried out in protest and made a move as if to run to Warwick's assistance, but at Xaol's gesture Bula caught her wrist.

Warwick, desperate, turned his head suddenly and bit Ipsu's right hand at

the fork. Ipsu groaned deeply, but did not let go. The next moment Xaol had stepped close and spurted dust into the stratoman's nostrils.

Warwick's head filled with sharp, spicy fumes. Many-colored pinwheels spun before his eyes. Then new and tremendous strength was swelling into him. Far from striking him down, the dream-dust was giving him super-human power!

With a toss of his head he shook off Ipsu's clutch. Xaol shrank back, seeming somehow shrunken and blurred. Perhaps that was because tremendous flashes of light filled the cabin. Then Warwick was out of the chair, his bonds bursting like dried grasses.

Ipsu was upon him from behind, but Warwick's strange new strength was more than a match for that great weight. A backward clutch, a forward heave, and Ipsu flew over his shoulder and through the air, mowing Xaol down.

Bula, still clutching the princess' wrist, stared fearfully. Warwick hurdled the fallen bodies of Ipsu and Xaol, flew across fifteen feet of floor, and smote even as he sprang. Bula collapsed like a doll at Princess Isis' feet. And then, as if his tremendous exertions took sudden toll, Warwick felt light-headed, dizzy, dull. . . .

GLOOM settled upon him, darkness. He did not see or hear for what seemed centuries, though he knew somehow that gentle hands touched his cheek and brow, that a beautiful face bent close.

When his wits returned, all was quiet and sweet odors touched his nostrils. He lay upon a pallet of broad leaves, soft as silken cushions, with a canopy above him of living boughs and flowers. And what flowers! Three feet across, with petals of orchid, pink or indigo, and with golden hearts. A strange red-and-silver bird hovered to sip nectar from the largest.

Beyond his shelter Warwick saw a gentle downward slope of shimmery sward that changed color in the soft, warm light—blue to lavender to orange—then back, like gas flames. At the foot of this was the brink of a cool green lake. In the shallows grew golden reeds that bore tufts of crimson bloom. And the lake stretched far away into misty distance, with gilded barges plying its far reaches. From those barges came music, like the mingled voices of flute and violin.

"Do you feel better?" asked a solicitous voice, more beautiful than the melody.

He turned his head slightly. There she was, Princess Isis Kentu, half reclining beside him. In that balmy air she wore only a silver bodice and a pearly-spangled kilt, revealing the smooth length of her polished, honey-brown legs, the sweet roundness of her throat and shoulders and bosom. She smiled into Warwick's eyes.

"You *are* better," she answered her own question. "You've been unconscious for days, weeks."

"What about Xaol and his Eskimos?" broke in Warwick.

"Forget them. The important thing is that you're recovering."

He was too overwhelmed by her to speak for the moment. Then:

"I suppose I should follow tradition and ask where I am."

She laughed deliciously. "You're on Titan."

"Saturn's moon? But—"

"You're going to say it has not been reached yet. But it has, and I brought you here to get well."

She touched the curve of his mouth with a slender forefinger. He made bold to purse his lips and kiss it, and she laughed again, happily.

"You like Titan?" she asked.

He gazed at the scene, touched with new light and color. "It's Eden."

"And we're Adam and Eve?"

Abruptly he caught her in her arms. She yielded gladly to his touch, and they kissed. Her fingers stroked his hair. His head swam, bells seemed to ring. . . .

ANOTHER voice spoke, a voice that he knew and hated.

"Do you see, my Princess? Have I convinced you that my counter-agent is effective?"

Warwick was back in the chair beside the stratocar controls, bound and

helpless. The hands of Princess Isis were the hands of Ipsu upon his head. Across the floor stood the princess, angry and aghast, under guard of Bula. Xaol, standing in front of Warwick, was cleansing a needle syringe on a bit of white fabric.

"Awake?" he asked mockingly. "So sorry to rouse you from pleasant dreams. What were they about—victory, wealth? Love?"

Warwick spat at him. Ipsu growled and his mighty hands twitched as though he would crush the prisoner's head, but Xaol gestured for him to stand away.

"I have proven my point, Princess Isis. I gave Skipper Warwick dust, then I roused him. In the matter of the counter-agent as well as in everything else, I have been ahead of you and your father." He laid the syringe upon the keyboard of the controls. "This is one more item for you to consider; if you do my bidding, I may even rouse your father from sleep—after I have taken over his holdings. And now to the business of marrying you to Bula."

"Xaol," said Warwick between clenched teeth, "I'll have nothing to do with this rotten trick of yours."

"No? On Mars, in ancient times, many stubborn opinions were reversed by the judicious use of scientific torture."

"Try it," Warwick dared him.

"Wait!" said the princess suddenly, and her voice, while no one could say that it rose, dominated for the moment. "Wait!" she repeated. "If I am to marry, can't I choose?"

Once more Xaol achieved his mirthless chuckle. "I have already explained, simply and fully, my reasons for marrying you within my little group of lieutenants."

"Yes, yes," broke in Princess Isis, "but does it occur to you that I might exercise a choice even there?"

Warwick stiffened in his bonds. He felt his face draw in baffled amazement, despite his efforts to keep it expressionless. What card was she playing?

Xaol's face-petals stirred slightly as if he, too, felt surprise. The weakly handsome Bula grinned nervously at the princess, and big Ipsu scowled behind his shoulder. The Martian spoke again.

"This is completely unexpected, Princess Isis," he ventured smoothly. "I chose the most attractive of my two friends."

"Attractive!" Princess Isis fairly quivered with disdain. "That scrap of a man?" Bula flinched before the sudden scorn in her eyes. "If a husband is to be forced upon me, let him have strength and substance."

Bula cleared his throat. "I have more strength and substance than you imagine," he said stiffly, and took a step toward her.

To the tethered Warwick it seemed as if Ipsu made half a gesture to prevent him.

"WAIT!" cried the princess once more, her voice really rising this time. "I demand the right to choose."

Her imperious tone halted Bula's advance, while even Xaol cocked his shaggy skull as if to listen respectfully.

The girl's eyes sought Warwick's for a moment. The stratoman felt his blood quicken. Perhaps she was going to suggest that he join the band and become her husband. If she did so, he would fall in with the suggestion, would swear loyalty to Xaol. And, once free again, how he would fight for freedom and for the woman who gave herself to him!

The deep black eyes were trying to send him a message. One of them fluttered ever so slightly, in a wink. Then Princess Isis faced back toward Xaol and the two Eskimos.

"I won't accept Bula," she announced flatly. "If I must marry here and now, give me Ipsu!"

CHAPTER IV

Woman's Wit

THERE were two moments of silence, so deep, so complete, that all could hear like bell-notes the double-muffled throb of the rocket engines,

the tick of the instruments.

Then both the Eskimos cried out at once—Bula in truly anguished protest, Ipsu in exultation.

"You don't mean it, Princess!"

"*Marry me?*"

Ipsu rolled almost majestically forward, his basket-broad face creased into a dazzled grin. The princess stepped to his side and shyly laid her small, soft hand upon his huge arm.

"What's this nonsense?" suddenly demanded Xaol, his mechanical tones shrilling like a steam whistle. "Princess Isis, I have said that your husband would be Bula."

The smaller Eskimo made as if to seize the girl. Ipsu's tremendous body appeared to swell in wrath and his powerful fists clenched.

"Ipsu, come away from that girl and do not be a fool!" ordered Xaol.

The giant deflated, was about to obey. Princess Isis' slender fingers tightened upon his forearm.

"Ipsu!" she appealed. "I chose you!"

And the big man smiled down at her for a moment, then fronted his master again.

"I stay by her," he rumbled defiantly.

Warwick, immovable in his bonds, could but stare in deepening and shocked surprise. Once more he had been deceived in Princess Isis. After his first change of heart toward her, he had set her down as brave, clear of vision, steadfast and honorable of purpose; worth fighting for. In his brief dream under the influence of the dust she had been as an ineffably sweet reward. But now that the victory of her enemies seemed certain, she was driving a despicable bargain—exchanging a dandified rascal for a huge clod. Disgust burgeoned within him, flavoring the whole affair with new bitterness.

As for the active figures in the present drama, they were arranged in a new order. Princess Isis and Ipsu stood against the bulkhead, her arm linked in his. Xaol and Bula, by the control units, faced their prisoner and her newly chosen mate with bodies set in attitudes of stern protest.

"Ipsu," purred Xaol, his voice soft but deadly, "you have exactly six seconds to forget your romantic idiocy and stand away from that girl."

"No!" bellowed Ipsu, his face writhing into a scowl of challenge. Bula grimaced in passionate rage and half crouched as if to spring at his erstwhile comrade.

"Hold fast, Bula," Xaol warned him quickly. "I am the holder of the final argument."

His tentacle crept from its wide sleeve, like a snake out of a bag; a snake with a head of gleaming metal. He leveled his MS-ray gun.

[Turn Page]

"Ipsu," he continued, with the effect of a mocking drawl, "I assure you upon my oath and reputation as a Martian gentleman that, if you do not obey me, I shall reduce you to a handful of decarbonized fluff. There will not be sufficient left of you," he continued earnestly, "to make one of your quaint terrestrial funerals worth while."

The nozzle of the weapon lined itself on Ipsu's broad breast. But Princess Isis, moving as swiftly as a bird in flight, flung herself in front of the big Eskimo.

"BLAST us both, then," she dared Xaol. "Blast us, and we go into ashes together. And you'll have had all your trouble for nothing."

"Do it!" spat Bula between white, clenched teeth, but Xaol's tentacle did not close upon the switch.

"Bula," he ordered in a stiff voice only half audible, "see if you can make them separate for a moment."

Bula's snarl-lines deepened in his villainously handsome face. He closed in on Ipsu's left flank. The larger man turned on him, but kept close to the princess.

"Bula, you idiot," she taunted, "Ipsu will take the head off of your shoulders like a daisy from its stem."

Ipsu nodded relishfully, his big hands opening and shutting. Undismayed, Bula moved stealthily closer. A sudden rush, and even his lesser weight might thrust Ipsu into the open.

Just then the princess leaped, her lithe young muscles propelling her like a javelin across the metal floor at Xaol. Luckier than Warwick, she got both her hands upon his MS-ray, one clamping upon its nozzle and the other upon his tentacle-tip.

Both Eskimos, moving at the same moment, grappled like bear and panther. The lighter, more agile Bula caught Ipsu by the collar and began hammering with his free fist at the massive jaw. Blinking, but not reeling under the blows, the giant closed his own hands upon his rival's throat and began systematically to throttle him.

At the first impact of Princess Isis' body against Xaol's, Warwick thought that the terrestrial girl might wrench the ray-weapon from the outlaw Martian. A man with normal Earth-born muscles would have had strength and to spare for such a feat. But the girl, though active and young, was of slender build, while Xaol, like many Martians who had lived for years upon Earth, had developed unusual strength against the pull of terrestrial gravity. Moreover, Xaol knew he was fighting for his life, and was desperate accordingly.

His first move was an attempt to pass his ray-gun to his other tentacle, but the Egyptian girl's grip on it was too tight to allow this. Xaol then whipped his free tentacle around her neck, its coil as lithe and tight as a noose of cable, while with one of his leg-appendages he tried to trip her up. As he wriggled and twisted, Warwick could hear the sharp snapping of the metal wires that held the Martian upright against his artificial spine. He was freeing himself for more deadly grappling.

New motion was observable beneath Xaol's flashing robe. More tentacles! Two of them shot into view, then a third, to seize and encircle Princess Isis' body. A fourth hidden tentacle appeared, to strive against her clutch upon the ray-gun.

"I am—old-fashioned," Xaol panted through the squirming petals of his face. "Most Martians coming to Earth have—extra tentacles—amputated. I kept mine—they are handy at times—"

The next minute the two had fallen. Princess Isis, struggling valiantly, was turned underneath, swathed and pinioned by a mass of creeping appendages, like a swimmer in the toils of a great octopus. And Xaol's violent thrashings and heavings had brought him out of his shredded robe, so that he appeared in his grotesque nudity of squashy body-bladder and fringe of attacking limbs. No monster of nightmares ever appeared more vile.

"I shall—kill you," he promised breathlessly.

HE bent the ray-gun against the girl, but even as he hooted in triumph and touched the switch, she

foiled its aim. The ray blazed briefly, like a slender stream of white fire, almost upon Warwick's bound feet. A moment later the stratoman fell sideward, chair and all, upon the floor plating.

The powerful metal-solvent beam had cut his seat loose from the clamps that held it to the floor.

For a moment he lay, half stunned by the fall. Then he realized what had happened. Rolling over, he rose upon his knees and bound hands, the chair still fastened to his back like the unwieldy shell of a great snail. With powerful surges of his hampered muscles he hunched himself along—once, twice, third time—and within reach of Xaol and the Egyptian princess.

The Martian, unaware of what his chance flick of the ray had done, was once more forcing the nozzle toward Princess Isis. Two of his upper tentacles still pinned her to the floor, while the remaining four were occupied with pressing the weapon into position. In another second he would succeed, would burn the girl out of existence! But in that second Warwick, trussed-up but desperate, had overwhelmed him.

The stratoman's sinewy hands, held together by the cord at their wrists, clutched in the fluttering tags of flesh on Xaol's skull. With all his strength Warwick dragged at them, as he might drag at two handfuls of hair upon the scalp of a terrestrial enemy.

An uncanny shriek sounded as Xaol's agonized breath rushed out past his artificial larynx, and then all the twining tentacles went slack and he fell away from the princess with his new assailant. The clutch and strain upon those sensitive petals had paralyzed him momentarily. While Warwick floundered sideward with him, wondering desperately how to follow up his advantage, the girl gained her feet. She held Xaol's MS-ray in her hand, leveled at the Martian.

"Lie still!" she commanded. "Move an inch, and I'll blast you halfway home to Mars."

The Martian collapsed, defeated, and Warwick inched and dragged himself out of the ray's field. At the same moment the ship gave a lurch. Its floor grew light beneath them. It was descending.

"We're dropping down," said Warwick hoarsely.

"To be sure." Princess Isis was smiling, her free hand at her disordered hair. "That will be the magneto-beacon at Jacksonville, drawing us in."

"Jacksonville!" growled Ipsu in amazement, staring stupidly above the limp form of Bula. Xaol, too, whistled mystifiedly.

"We are heading northward," protested the Martian. "For Greenland."

But Princess Isis shook her lovely, tousled head.

"Not this trip. At the beginning of your attempt, Xaol, while the lot of you were struggling with Skipper Warwick, I had a moment alone at the controls."

"After I had laid the course north?"

"Yes. I put it back as it was, then smashed the compass to cover up. None of you has taken time since to notice that everything was changed. We're coming into Jacksonville, as per schedule."

Ipsu, slow of wit, still gaped. The Egyptian princess, ray-gun poised in her right hand, tugged hard with her left to untie Warwick. When free he rose, stretched his cramped limbs and took the weapon from her.

"WHAT—" began the big Eskimo uncertainly.

Princess Isis shook her head and smiled, somewhat apologetically.

"Sorry, Ipsu." She was binding Xaol's tentacles with the ropes that Warwick had thrown off. "It may have been cruel, but I had to use whatever weapons I had. I saw that you were strong and brave, so I turned you against your friends."

Ipsu grimaced ruefully. "So that was it," he mumbled.

"That was it," Warwick assured him, gaining understanding in turn. "After all, one bad turn deserves another."

The giant made a helpless gesture and sank heavily down upon a chair. "I might have known it was too good to be true," he groaned, like a child deprived of sweetmeats.

The unconscious Bula uttered a weak moan and stirred where he lay on the floor. Ipsu picked him up like a clumsy nurse handling a drowsy baby.

"The princess," he said wretchedly to the reviving Bula, "will—that is, she don't marry either of us."

"If you fools had not been determined to kill each other," accused Xaol, bitterness in his artificially cadenced voice, "all would have been well."

The ship was dropping down through wreaths of cloud, its ports now dulled by the vapors, now bright with sunshine. Princess Isis and Warwick took time for a glance at each other.

"We did it, Skipper," exulted the girl.

Warwick shook his head. "You did it, you mean," he amended. "All I did was dog-fight and end up helpless. You were the one who figured a way out, and took it."

"But ropes and all, you rescued me," she reminded.

Xaol made a harsh buzzing sound. "Please spare us these exchanges of compliments. You have no idea how distasteful is the subject."

"You got us into this, Xaol," accused Bula hotly and Ipsu nodded corroboration, solemn as a big owl.

But Warwick and the princess ignored this falling out among the captives. They stood close together, the stratoman's eyes smiling into her dark ones.

"My father will be awake within a day or so," she said, taking Xaol's counter-agent syringe from the keyboard.

"And will resume control of Spaceways," added Warwick.

She nodded. "I know what his first action will be," she went on. "He has never refused me a favor yet. So, when I ask him to engineer the promotion of a certain very gallant and competent stratoman to the interplanetary service branch—"

She put a hand in his, as if already congratulating him. He, greatly daring, bowed to kiss her tapered fingers, and they gave his own a quick, warm squeeze.

The ship vibrated wit a sudden new shock, then all was still. Stratocar No. 2 had come to rest at Jacksonville Rocket Field.

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HOLLYWOOD ON THE MOON

A Novelette of the Filmland of the Future

By HENRY KUTTNER

—in the Next Issue of THRILLING WONDER STORIES

VIA ASTEROID

Many forms of life were sighted as they went along.

Mars Expedition Number One Survives the Frigid Wastes of an Alien World for Eight Hundred and Three Days! And Then—

By GORDON A. GILES

Author of "Via Etherline," "Vision of the Hydra," etc.

HELLO, Earth! Mars Expedition Number One resuming contact with Earth, via Mars etherline. Seven hundred and ninety-first day. Gillway speaking. Your message requesting code contact, in place of the click-signal, was received yesterday, and today I hooked up all available batteries. Hope this is going through to you.

We certainly are overjoyed to establish code contact once again. In fact, we went wild when your message came in yesterday. The Martian year is a long one. We have been once around the sun, while Earth has circled it twice, since we last exchanged messages. Fred Markers has computed that just eleven months ago we were 260,000,000 miles apart. The thought

alone was rather frightening.

The 791 Earth-days value is another of Markers' calculations. He requests a check on that—wants to satisfy his own curiosity. He figured that Earth's International Dateline shifted across the Martian meridian twice: at opposition two years ago and at conjunction a year ago. His other values are: 740 Earth-days for the time we've been on Mars; 721 Martian-days for the same. Thus the coming opposition will occur fifty days from now. Is he right?

There is much to tell. First of all, I'll say that the seven of us—Alado is dead—are in good health and feel like native Martians. But we haven't renounced Earth. In fact, we are at present busily engaged in manufacturing rocket fuel for the return trip. My last report, made almost two years ago, stated that our ship was a ruined tangle, so I will have to explain.

The situation two years ago was this. The ferocious three-foot ant-creatures had besieged us in our clay house and were attacking each day. Proosett and Cruishank had lost their lives. Our sole defense had been the seleno-cell which we were using to electrocute the enemy. A spark had leaped to our ship and exploded our fuel reserves. Thus we seemed faced with doom—we were automatically marooned, and hemmed in by a numberless enemy.

I must admit now that I had unwittingly painted the picture darker than it was. For, a week later, the situation had changed. Unaccountably, the insects vanished. They simply failed to appear one day, though we had seen legions of them in the hills. We never saw them again. Swinerton, our biologist, reasoned that they were similar to the driver-ants of Earth—warring nomads that never stay in one locale, but march onward steadily.

They attack and eat all in their way; but our clay house and space ship were indigestible, fortunately. Though they got Proosett and Cruishank, damn them!

When we were free from the insect menace, we found that our space ship was not as badly damaged as had seemed. More on that tomorrow. My batteries are low.

Can you give us some music? We haven't heard any for two years, though Dordeaux plays his guitar well and we struck up a passable quartet—Swinerton, Greaves, Parletti and Captain Atwell.

SEVEN hundred and ninety-second day.

Thanks for the accurate check-up on Markers' figures, though it has the doubtful virtue of confirming our belief that we cannot cross during this opposition. We are faced with the hard fact that we cannot possibly manufacture enough fuel for a return trip at any decent speed. But we're hoping to scrape up enough to get us drifting toward Earth's orbit, to be picked up a year later. That is, on the supposition that our ship will survive the trip, not to mention our supplies and ourselves.

About the ship. The fuel tanks, as you know, were distributed in circular form at the rear, adjacent to the hull. The explosion tore the rear end to shreds. Since that was the end visible to us from the clay house, our impression was that the entire ship had blown up. But when we looked it over, we saw that the forward part, including the fore-engine, was intact. Fortunately, all supplies had been removed earlier from the ship to our house.

Captain Atwell promptly announced that we would make repairs. It would be useless to detail just what we did over a period of three months, working with the few tools we had. Using a makeshift hydro-oxy torch devised by Alado—both gases from our electrolysis plant at the pool—the ruined back part of the ship was shorn away.

A bulwark of scrap metal was built over the unsealed end and welded as carefuly as possible. As a further precaution, an inch of tar was coated over all seams. The tar we made from partial combustion of native shrubbery in underground kilns.

There it stands, outside the window now, a half ship. Actually, though, it is two-thirds of its former length. The gyroscope was set up in the ship's mathematical center of gravity, so the thing was ready to sail, except for one thing—fuel.

That, Captain Atwell said, we would see about. With characteristic foresight, he had planned for the future. And not until all that was done, and our camp had been thoroughly established, did he allow exploration, which was the main purpose of our expedition. We had been on Mars, then, fifteen weeks.

As I mentioned yesterday, we are at present making the fuel that we hope will take us back to Earth in our half ship. Yet, a few, long months ago, we despaired of ever having the fuel. For it was just two months back that Parletti, with his indefatigable pick and shovel and microscope, found a natural deposit of rich selenium ore, not fifty miles from our camp. But that, and other details about this all-important manufacturing of fuel, will come up later in my reports.

Thanks for the music. Our favorite number was the song dedicated to us, *Moons Over Mars.*

* * * * *

Seven hundred and ninety-third day.

After the repair of our ship, we had about a month left before the fall season set in. The seasons here, of course, are just twice as long as Earth's.

Captain Atwell picked an exploring party composed of Swinerton, Dordeaux and Parletti. Well-armed, carrying knapsacks of food and canteens of water sufficient for a week's rations, they struck out westward, for the nearest canal. The large oxygen tanks strapped on their backs did not bring their total mass to even three-quarters of Earth-weight.

Markers, Greaves, Alado and myself remained behind to keep things going. There was always something to do at camp. The electrolysis plant must be run and tended six hours a day to maintain our oxygen supply. The selenocells must be periodically adjusted or they will overcharge. The sun-power mirror on the roof must be polished twice a day; this supplies us with the current to heat the clay house.

The rest of the time we amused ourselves playing cards and chess. Now and then we'd go hunting in the bush-wilds of our pool for small game. We have developed quite a taste for the lobsterlike steak they furnish, these semi-insectal creatures of Mars.

The party returned in due time, tired and frost-bitten. Captain Atwell was calm, but Dordeaux and Parletti were excited. They both poured out simultaneous explanations. Swinerton didn't help by chiming in with the chorus. Atwell shook his head with an amused grin when we turned to him. Evidently he wanted them to tell about it.

It was a dozen minutes before their incoherent archeological, geological and biological jargon made any sense. In fact, it wasn't until Markers took command, shut them up, and had them each speak in turn that the story came out with any degree of clarity.

One of my batteries just faded out. Will repair and continue tomorrow.

SEVEN hundred and ninety-fifth day.

The party had reached a canal about a hundred miles west, after two days of rapid hiking in the light Martian gravity. It looked like the shore of an empty lake at first. But the startling straightness of the shoreline indicated that it was really one of those remarkable canals that have puzzled Earthman's eyes since the telescope was invented. The other bank was not visible. As Earth's astronomers have estimated, the canals must be at least fifty miles in width to be visible from Earth.

Starting down the slope, and growing ever thicker toward the bottom, was a jungle of dwarfed plant growth. Though they did not investigate, it was evident that an appreciable current of water must still be circulating in the center of the enormous canal, enough to give life to this oasis in the surrounding desert land.

They could only gasp at the thought of what a tremendous river must once have swept down that great waterway, ages and ages ago. Perhaps all the land which we have seen as desert, and which is ochre-red in our telescopes, was once irrigated by this amazing sluiceway.

They decided to follow the line of the canal southward for two days. Many forms of life were sighted among the bushes and trees they skirted. Swinerton swears he saw a creature

with two heads, one at each end of its body. The others did not see it, but they did see a ten-legged monster a dozen feet across that was like a giant spider. Also, a creature that was nothing more than a huge wheel rolling along, with a head in the center.

In explanation, Swinerton reminds us that evolution has had many more ages to produce odd monsters here than on Earth. Yet he says they are just vanishing remnants of what Martian Zoology must have had in its flower, about a million years ago.

* * * * *

Seven hundred and ninety-fifth day.

Well, they had to drag Swinerton along by force to keep him from running into the jungle for closer looks, and tramped on.

The next day Parletti became excited when the shore changed into a cliff and exhibited striations which, to his scientific eye, meant much. He counted them, examined them with binoculars, and began to babble about Martian geology.

He declared that Mars had once had oceans as mighty as those of Earth, in proportion. Highly saline oceans that must have been rich in gold. This ties up with Greaves' analysis of the desert sand, formerly ocean sediment, which is thick with red gold. Gold is what gives the Red Planet its ruddy color in Earth's telescopes.

Greaves seriously maintains that every time we take a step on Mars we are walking over a dollar's worth of gold! Swinerton subsequently established that even the life of Mars is impregnated with gold. He coagulated a sample of blood with a tin salt from his biological kit and obtained the characteristic iridescent purple of colloidal gold.

To get back to the canal, Parletti estimated the beginnings of life on Mars as three billion years ago! The planet, he says, passed its prime over a billion years ago, when Earth was still a hot, restless globe of steaming rocks.

But the man that was most astounded and really stirred with interest was Dordeaux. This happened late that day when they saw something come up over the horizon. It was a broken line of walls and towers glinting in the sharp sunlight. The ruins of an ancient city!

As he told this, the four of us who had not been along hung on every syllable. There was nothing so intriguing, so compelling, on this strange, new world as the thought of former civilizations.

"Huh!" grunted Dordeaux, eyes snapping, "You fellows wouldn't believe me when I said I had seen those ruins from our space ship while we were landing. Now who's right?"

As a matter of fact, we had kidded him an awful lot about it, taking nothing for granted, but were just as thrilled as he was to hear the news. For it was the first definite proof of another intelligent race in the Solar System besides Earth's.

The party reached the city-ruin the next morning and investigated its hoary, lichen-covered remnants. Not much remained beyond broken, eroded walls of stone and a general débris of rock and heavy dust. However, they could make out the general plan of the huge city, built much like an Earthly city in squares. Numerous bas-reliefs showed clearly that physically, the Martians had been more insect than animal, with wide wings. The early heavy atmosphere, coupled with the light gravity, had made flying a natural equipment of life.

Captain Atwell had had to keep a sharp eye on Dordeaux. His archeological instincts had been fully aroused and all others submerged. He was liable to dart off any second to examine some new thing that had caught his eye. No wonder; here he was in a complete new world of archeology, uncatalogued, mysterious, alien. His enthusiasm was so contagious that it fired us all as we listened to him.

At any rate, the grandest thing of all was discovered later that day, as the four stood at the canal bank's edge. Broken edges of a smooth, wide sheet of metal speared up from the canal's bottom, caked with ages of rust. At once it was apparent that it was a section of what had been a tremendous pipe fitted into the canal, and as wide! The Martians had undoubtedly used a

pump of some kind to move the water from the poles along that pipe. The water itself would never have flowed uphill in the canals from the depressed poles.

Dordeaux pictured for us the colossal engineering achievement of a network of canals all over Mars. Giant pumping stations such as this one every few hundred miles. Millions of square miles of parched land irrigated. A dying world made fit for life long after its prime. A heroic struggle against the inevitable. And now this, the shards of civilization!

Dordeaux, from careful microscopic examination of rocks and bones, has since come to the conclusion that that city, and perhaps all the others, had been flourishing not more than fifty thousand years ago!

SEVEN hundred and ninety-sixth day.

Those were the results of the first exploration away from our immediate vicinity. Dordeaux maintains that it is not unreasonable to suppose that Martians are surviving today. Perhaps some few groups have managed to withstand the rigors of cold near the poles and live near its plentiful water supply. We all agree it is possible.

Another trip was made to the canal. This time Markers brought his photographic equipment along. They came back with several hundred excellent views of the canal, city, animal life and geological formations. The home staff of scientists will find these pictures highly interesting—if we ever get back with them. Markers also took a hundred feet of moving film, photographing the city from the highest broken wall he was able to clamber.

Thanks for the program dedicated to us yesterday. Particularly give our thanks and appreciation to President Mason for his fine, inspiring speech. We feel a little guilty about all the praise and eulogy he heaped on us. We don't consider ourselves "cosmic heroes," President Mason, but we like the words anyway!

* * * * *

Seven hundred and ninety-seventh day.

No more explorations were made as the fall and winter set in. And what a winter! The highest temperature we recorded in six months was 20 below zero. Once it dropped to a record low of 120 below.

During that time we stayed in our clay house, venturing out only to perform the necessary chores of readjusting the seleno-cells, polishing the sun-mirror on the roof, hauling ice from the pool for the electrolytic plant, etc. Captain Atwell took a regular part in this and all other things. He is the one, we unanimously agree, who should get credit for all our success. A leader and a man!

There was no snow, of course, but at times during the coldest snaps a light frost coated our windows—of carbon dioxide snow! Wind storms that lashed sand against our walls rose at frequent intervals, but never lasted more than a day.

We were quite snug in our sturdy clay house, our heater supplied by the current of the sun-mirror. But during the coldest spell, when old Sol was lowest on the horizon and our mirror did not build up much charge, we had to put on our heaviest clothes to offset the freezing temperature in our house. Even our drinking water froze for three days. We had to warm our protein-sticks next to our skins before eating them.

Greaves came in once with a badly frozen pair of feet, tending the electrolysis outfit. He had been out only an hour. Atwell had us take fifteen minute shifts on our outside chores after that. Greaves was well taken care of by Parletti, but lost two toes. However, that extreme spell lasted only seventeen days. The rest of the time it was more like a severe Arctic winter on Earth.

Monotony set in with the winter, of course. We would have given our souls at times for music, or even an advertiser's voice from Earth. We played games until we were sick of them. A rotating game of bridge lasted for almost a month between the eight of us. Nobody won, though the rubbers ran into three digits. The law of averages evened everything out over

that long stretch. We then paired off with permanent partners. Alado and Swinerton ran up so many points in two months that if paid off at a thousandth of a cent a point, they would have owned us lock, stock and barrel.

Alado chuckled at his winnings.

"By glory," he said, "when we get back to Earth, we ought to challenge the Culbertsons, eh, Swinny?"

He didn't know—God rest him!—that seven months later he would be buried under the red sands of Mars.

Quarrels arose, an inevitability. Yet they never became bitter, or prolonged. The feeling of being alone on an alien world knitted us together like brothers. Our strict system of share-and-share alike, under the iron discipline of Captain Atwell, gave no permanent grounds for differences.

We celebrated Christmas and New Year's by singing all the appropriate hymns and songs we knew, accompanied by Dordeaux' guitar, and having a feast of an extra bowl of hot bouillon each. We celebrated the Fourth of July, too, before the long Martian winter was over!

SEVEN hundred and ninety-eighth day.

A waterless thaw came with the rise of the sun toward the zenith. The daily temperatures began to average around zero. We were able to go out and relieve our cramped muscles in short hikes.

It was at this time that we talked over the fuel question seriously. We had been afraid to before that. Our only hope, of course, was to find a supply of selenium. Greaves promised to extract it from the ore, if some ore were found.

Captain Atwell commissioned two search parties to make constant explorations in all directions. Parletti, Swinerton and Alado as one; Dordeaux, Greaves and himself in the other. As soon as weather permitted, his plan was carried into operation. Each party leader was to make tests of underlying soil every mile, carrying along small chemical kits for flash tests. The others were free to catalog any other phenomena on the way, if it did not mean too much delay.

Atwell had worked out a system of routes and directions which made it simple to survey new territory every time. The constant sun and strange but true compass that had a north pole in the east were their guides. In all, the two parties made a total of sixteen one-week, and ten two-week treks into the surrounding territory, in a period of nine months.

It was during one of these trips that Alado came down with inflamed lungs. He was put to bed and nursed carefully, but pneumonia set in. He was dead a week later. Not a hero's death, but he died with a smile. His last words, with his eyes fixed on the brilliant evening star, were simply: "Good-by, Earth!"

We buried him at night under the two moons of Mars. We will not broadcast tomorrow in his memory.

* * * * *

Eight hundredth day.

Opposition time is drawing near. How we would like to cross at this time! Yet we won't be able to do it. We will have barely enough home-made fuel, crude and inefficient, to drag the ship away from Mars and set up a drift sunward. We will have to time it just right or we will miss Earth next year.

We are not trying to fool ourselves. Our chances of a successful navigation with a half-ship and crude fuel are small. Most of all, it will be a close race between time and oxygen starvation for that year-long trip. But we can't stay on Mars, either. Our preserved food supply is running short. We could never live on what we hunt—our ammunition is almost gone. Even our sun-power units are beginning to balk, and they are the only thing between us and freezing on this cold, cold planet.

So we will have to take our chances in our half-ship.

It was nine months ago that the two exploring parties began to range over our surrounding territory, searching for selenium.

Markers and I, who were left in camp all this time, had enough to do to keep us going from dawn until dark. But

Markers, with energy enough for two men, found time to make careful observations through his four-inch telescope on the roof. He has discovered two new moons of Jupiter, tiny far-flung ones. Also one for Saturn and even one for Pluto. He says the thin air makes telescopic observation on Mars ideal.

He has made complete records and computed orbits of the moons, and of the eleven new asteroids he has charted. He spent most of his time with the asteroids. He is especially interested in the one called Anteros, which he says has a very eccentric orbit. He has worked its orbit out to seven decimal places.

Several times he had me look through his tube at the beautiful sights of Jupiter with his colored bands and Saturn with his remarkable Rings. But the sight that fascinated me most was that of Earth itself, a green-gold half-sphere with bright cusps. The north polar cap sparkled like a diamond and most of the surface was covered by a filmy gauze of white clouds. But through it could be seen the continents and oceans, so familiar that it made me choke.

This is perhaps unbelievable, but the city of Chicago is visible as a tiny pinpoint of light. I saw it just as that longitude of the American Continent swung past the terminator, from light to dark. Chicago, from this distance, seems to lie in a great dark hollow edged by the shimmering-white Lake Michigan. Just as it swings into its sunset, the lake becomes utterly black and the hollow blacker, and the city flames out like a tiny jewel.

Markers, who is from Chicago, looked when I pointed it out. Then he walked away and didn't say much for the next hour. But then, nostalgia has hit us all pretty hard.

One other man-made landmark is visible, the great Chinese wall. It appears as a winding silver thread over the dark mountains of Mongolia.

Markers and I had a scare once. In the middle of the day we heard a loud explosive noise from outside. We put on heavy clothes and air-helmets and ran out. It was the electrolytic outfit, down by the pool. A leak had allowed oxygen and hydrogen to accumulate in an explosive mixture. A spark had set it off. Much of the glass tubing had been shattered.

Having just sent the two expeditions out with all our surplus oxygen, we were faced with an immediate shortage of that gas for ourselves. We set to work like demons. Markers, an all-round expert in any laboratory, blew the necessary tubing and I helped as much as I could in setting it in place. It was an all day job. For the last three hours, we breathed and lived in Martian air, having run out of oxygen.

Both of us came down with heavy bronchial colds that night. We drank boiling-hot — 138 degrees on Mars— water and wrapped ourselves up with blankets to bring on a sweat. A week later, when Parletti's party returned, we were still weak and feverish. Parletti, changing from geologist to doctor in a second, nursed us out of it.

That was how close, at times, we played the game with death.

EIGHT hundred and first day.

As a brief summary of what the two search parties found in their constant exploration, I'll mention first the strange desert crypt that Atwell, Dordeaux and Greaves came across to the east.

It was a pyramid so similar to those of ancient Egypt that they thought they were having halucinations. Dordeaux fell to his knees in the sand and almost fainted. The whole thing was a puzzle. The inscriptions around the base were unlike those of the Egyptians, but had a haunting familiarity.

There was no way to enter it. Dordeaux would just as soon have begun hacking away with his pick, but Atwell emphatically vetoed the idea. Pictures were taken of the inscriptions for analysis on Earth. Dordeaux raves—it is the only word—about a Martian visitation of Earth, only ten thousand years ago. It remains a mystery. Perhaps it will be cleared up in the future by other explorers with the necessary equipment to enter the crypt—if it is one.

If that is startling, what about the

other party finding in the ruins of a canal city a perfect representation of Neanderthal Man of Earth? It cannot be of the Martian race, for they are insectal. Does it mean that Mars once had a humanlike race, which vied with the intelligent insects who built the canal system? Or that the Martians had visited Earth before the dawn of our history?

Swinerton, as anthropologist, has complete pictures of and voluminous notes of this find. He is saving them for leisurely examination on Earth.

* * * * *

Eight hundred and second day.

The most important find of all, of course, was Parletti's, just over two months ago. His spade turned up a rich ore of selenium, fifty miles from camp. All other pursuits were immediately abandoned. Greaves made his analyses, and with the collaboration of Markers, and the whole-hearted help of the rest of us, set up a plant to manufacture fuel.

His method was simply ch orination of the ore, producing selenium tetrachloride, a heavy liquid that could be separated from the by-products mechanically. Chlorine came from e ectrolysis of brine; the brine from our salt pool. The tetrachloride was treated with water, producing selenium oxychloride, which is perhaps the most active liquid known next to the fluorine compounds. And the fuel whose powerful explosions bring life to rocket engines.

We have been working like slaves. Parletti was stationed at the ore deposit, to dig up the hard, rocklike material as fast as he could. Atwell and myself, the two heaviest men, made the treks back and forth, dragging the ore along in a huge canvas toboggan.

At the camp, Swinerton pounds the ore with a large mallet, making it fine-grained. Greaves then gets it and dumps it into his chlorination vat. Markers tends the electrolytic outfit that produces chlorine.

How fortunate that Mars is a dry world without clouds or rain. One day without the energy of the sun to give us electrical power and we would be lost!

Greaves' complicated chemical manipulations finally produce the fuming ye low liquid that Dordeaux carefully pours into valveless oxygen tanks and stores in the ship.

For six weeks now we have been working eighteen hours a day at this project. We have made a gallon of fuel a day. Just today Parletti limped into camp, cold and aching from his labors, and announced that the selenium deposit had run out. The remaining ore was poor and useless for our purpose.

Make it or break it, we will have to get along on what fuel we have. It is barely enough, Markers computes, to get us away from Mars and set us on a slow crawl toward Earth's orbit.

Markers has a strange gleam in his eyes, and has had for days. Atwell is watching him carefully. I didn't think Markers was the type to break down, but it looks that way.

EIGHT hundred and third day.

Markers speaking! We will cross during this opposition! By some cosmic chance, the asteroid Anteros will pass no more than five million miles back of Mars ten days from now. We can build up a speed of five miles a second and meet it. Allowing it to sweep by our ship close enough, we will be caught in its gravitational field and take up an orbit—providing our ship stands the strain.

Anteros has an extremely eccentric orbit, more so than even Eros. Some decades ago, I forget just when, it passed within a million miles of Earth, nearer than any celestial body except the moon. My calculations show that it will repeat this maneuver at this opposition, passing within one and a half million miles of Earth.

Riding the asteroid from Mars to Earth, we will have fuel enough to escape Anteros at the proper moment and fall to Earth's moon. If we have fuel enough, we will attempt a landing on Earth itself, although since Anteros will pass in front of Earth in its orbit, Earth will bear down on us at its orbital speed of fifteen miles a second.

However, the moon will be receding at the time, lessening the speed of her approach to our ship to nine miles a

second. We can more easily take up an orbit around the moon, without danger of being burned up in an atmosphere such as Earth has.

Captain Atwell speaking! We will ride the asteroid Anteros as Markers has explained. It is perhaps a dangerous experiment, but a lesser evil than drifting in space for a year, and that is a lesser danger, in turn, than staying on Mars. We will be circling the moon, if all goes well, forty days from now. We will contact you at that time by etherline and plan a landing at some known Lunar location, where we will wait for a rescue ship.

Gillway speaking. Markers had that plan in his mind for months, ever since he caught Anteros in his telescope and plotted its course. He exploded the news like a bombshell this morning. We all became madmen for hours. Then we set about seriously to plan our strange trip via asteroid.

We will leave tomorrow morning. I will not be able to broadcast again until we have safely hooked our ship in an orbit around Anteros, ten days from now, as all available battery power will be needed for the gyroscope.

Au revoir. Mars Expedition signing off at Mars.

* * * * *

Eight hundred and thirteenth day.

We have succeeded! We are circling Anteros! The ship is bearing up nicely. All else is well. Markers says the worst is yet to come. The landing on the moon or on Earth itself will be hazardous. But we have something of a fuel reserve and plenty of hope and courage.

Will not broadcast again until near Earth, a month from now, as the sunpower mirror has gone dead and my batteries are low.

Mars Expedition Number One signing off.

NEXT ISSUE

ECLIPSES OF THE SUN

A Special Article by

SIR ARTHUR S. EDDINGTON

—One of England's Most Famous Astronomers

ZONES OF SPACE

A Complete Novelette of the Sunken World

By MAX C. SHERIDAN

Author of "Interference," etc.

CHAPTER I

When Science Went Mad

NEIL DANSON jammed the starboard throttle wide open and braced his body for the wrenching jerk as a thunderous roar of rockets heeled his tiny space ship in a tight arc to port.

The shrill scream of the photo-siren lanced his ear-drums and almost drowned his frantic shout of warning—

"Bert! Meteoroid dead ahead!" he cried hoarsely.

The violent lurch of the sweetly responding little ship threw him with bruising force against its asbestos-padded side, even as a crunching jar to the fore sent him sprawling full length.

"Hit the meteor!" he thought dully. "We're gone!"

His head ached fiercely as he waited for the dooming hiss of escaping air.

Mankind was being

"What's the big idea?" came a feeble complaint from Bert Baker at the far end of the little cabin. "Might as well kill a fellow outright as to scare him to death!"

And still there was no hint of that fatal sound which meant a punctured hull. Danson sat up and held his throbbing head.

"Sorry, Bert, that I disturbed your peaceful nap, but a little chunk of iron about twenty feet in diameter got in my way."

Mankind Meets the Challenge of Atlantis

put to the most soul-despairing test since the dawn of time

Bert Baker disentangled himself from the blankets which had enfolded him like a cocoon when the sudden lurch of the ship had rolled him from the low couch.

"Where'd it hit us?"

Danson came to his feet gingerly, hobbled across the cabin.

"Right on the starboard tanks, I'm afraid." He paused a moment. "But, after all, that's the only thing that saved us. If it hadn't been for the cushioning effect of the fuel, I wouldn't be telling you about it."

He pressed his hand on the inward swelling bulge in the asbestos-lined side. "Meteor pushed both her hulls in a foot or so, but she didn't break. Pretty nice work you did in designing the alloy, old man. Must have stood a little thing like a ten-thousand pound blow then."

"If she hit us directly on the fuel tank, why in thunder didn't we go up in a cloud of smoke?"

Danson rubbed a throbbing bump on

When a Lost Continent Defies the World!

the top of his head, and scowled.

"There's the joker." He pointed to the fuel gauge on the instrument panel. "A sharp point must have poked a hole through the outer hull, and our 'Nitrone' sprayed out like water from a squirt gun when you push on the plunger."

"Empty!" Baker adjusted his twisted spectacles and stared at the gauge.

"Empty," echoed Danson, with a crooked grin. "Looks like I'll have to eat your rotten cooking the rest of my life."

Baker's elfish face grew grave as he caught the import of the other's words.

"You mean we won't have enough fuel to go back?"

Neil Danson shook his massive head slowly. "We'd use up the rest of our fuel even before we decelerated enough to start a return arc. No, Bert, old man—we might as well cut off the fuel and coast on to the moon. We're past the gravitational zero point between good old terra firma and Luna now, and if we coast the rest of the way, we'll probably have about enough fuel left to make a safe landing."

"And then what'll we do—sit and twiddle our thumbs until we run out of oxygen?"

"We'll do what we started out to do—make observations on that queer dark-zone around the constellation Lyra. We'll find out whether we can tell anything more about it without cloudy air to impede our vision—even if we don't return with the information."

Baker scratched a generous ear.

"Why not?" he said. "Maybe we can reach Earth with the radio, anyhow, and give them the dope on it."

Danson shook his head. "Not a chance of that. We'd have to have a broadcasting unit bigger than the whole ship to stand a chance of bridging the two hundred and forty-odd thousand miles between the earth and moon. But at least we can satisfy our own curiosity on the thing!"

BACK on the staid and solid Earth, some two hundred thousand miles from the tiny battered sliver of metal hurtling through space, the members of the board of the United States Patent Bureau were having a circus.

Bearded patriarchs slapped each other on the backs and chuckled with glee. The younger, more dignified members either wore supercilious smiles, or vocally expressed their amusement with low-voiced comments.

"I thought they outlawed applications for patents on perpetual motion fakes a while back," one scientist told his companion.

"They did, but this crank Norton has some pull, and now we've got to sit through a silly farce."

THIS was a momentous occasion. It was the ten thousandth application for a perpetual motion patent, and if it worked a million times as well as the others, it wouldn't develop enough ergs to pull the hat off the head of anyone present.

The apparatus mounted on the platform before the scientists was of rather simple design—as perpetual motion machines go. It consisted of a system of electro-magnets mounted on the spokes of a rimless wheel. From each magnet, two wires ran down each spoke to a split commutator which formed the hub. Bolted to the hub, and turning on the same axle, was a tiny generator with its discharge contacts leading to the commutator. Suspended by a separate stand, above the wheel, and directly vertical from its axis, was a small steel ball.

The inventor's explanation droned on monotonously.

"The theory of my machine," he said, "is that the wheel with its electro-magnets must be given an initial impetus which would start the generation of electric current in the tiny generator. The current will flow along the wires to the commutator which will in turn impart it to the ascending magnet closest to the steel ball at the top of the circle. Just as the now-attracted magnet reaches the top of its arc, the commutator will cut off its current, and send it in turn to the next lower magnet—"

"Very nice," interrupted one of the Board, "except for the fact that the

whole thing is only a roundabout way of making the generator develop enough power to run itself—overcoming resistance and friction."

His neighbor nodded, and they both waited with visibly suppressed indifference for the imminent test. The demonstrator released the catch and gave the wheel a hearty spin.

"If you wind it up enough, it *should* run forever," jested one technician.

The audience waited for the thing to lose its initial impetus, gleefully anticipating the time when it would come to an inevitable stop.

They waited in vain. Slowly the tiny spokes become a solid disc as the wheel increased its speed of revolution. It neither faltered nor jerked, but built up its angular velocity until the whole apparatus was vibrating with alar ing violence.

Strangled gasps sounded from all sides. Wide-eyed doubters swallowed their mirth and found it disagreeable. Grey-faced scientists wiped the cold sweat from their foreheads and started thinking psychopathic thoughts. For they were watching a perpetual motion machine—and it worked!

* * * * *

Same day. The *Delano*, America's newest and finest battleship, steamed slowly along on the almost glassy surface of the calmest Atlantic in months. Far out to the east, a wisp of smoke trailed slowly upward in a spreading plume as a ship slowly dragged an abandoned hulk on which the *Delano* was to demonstrate the almost miraculous accuracy of her tremendous guns.

The gigantic turrets revolved slowly in tremendous arcs as the crews gave every control a last-minute test. Gunners and crew were tense with the determination to carry out every order to perfection. The observer stood by watchfully.

Came the command. Crews flashed into sudden, smooth action. Huge shells slid silently into yawning breeches.

"Range—" Deft fingers raced.

"Aim." Turrets nosed to the distant speck like pointers on the hunt.

"Fire!" Thunder with a thousand voices blasted the silence.

"Missed!" The observer shot out tense orders. He was puzzled.

"Range— Aim. Fire!" Again the costly projectile missed its mark.

"Range— Aim. Fire!" The Goliaths of destruction boomed resentfully and waited, then crashed out their thunder again with a faintly querulous note. For the deadly missiles were plunging into the calm blue waters of the Atlantic successively further and further beyond their target, overshooting it completely.

Huge rifled barrels were hastily examined. Sighting mechanisms and calculations were checked and rechecked. Ballistics experts were called on the carpet and declared rank incompetents.

But one fact remained. Gargantuan monsters of destruction with scientifically perfect range finders, gauges and 'scopes, were somehow unable to find their marks.

WILLIAM J. JONES looked down into the laughing upturned face of the girl beside him, and squeezed the hand which clung tightly to the crook of his elbow.

"What a chance for romance!" he laughed. "Boy and girl—together under the pale silvery light of the drifting moon, and the myriad tiny twinkling stars. Soft whispers and low tender words. Romance under the great hemispherical dome of—a planetarium."

"Artificial heavens and moon and stars, but not—" The girl's voice was tender.

"Not artificial romance," he completed solemnly.

Then they were quiet while the lecturer began his talk.

"Planetaria are not a recent innovation. One of the first crude planetaria, an Orrery, was constructed for Charles Boyle, Earl of Orrery, in the early seventeen hundreds by one Graham. It was a rather crude mechanical device, and was consequently unable to demonstrate the wealth of heavenly phenomena which the more recent, projector type planetaria can show with the utmost facility and exactness. For,

you see, the science of light is an exact one; and not subject to the whims and foibles of a purely mechanical apparatus."

The lights dimmed slowly, and a central blazing spot appeared in the dome of the heavens. Nearest it was the tiny dot which represented the planet Mercury. Still further from the sun was the larger silvery disc of Venus. Then the ball that was Earth, with its satellite, Luna. Next came Mars with its two tiny attendants, Phobos and Deimos. Then, far out in the heavenly dome blazed the huge Jupiter with its nine tiny orbs; then splendid Saturn with its mysterious rings and ten companions; Uranus with four; Neptune with one; an far out at the extreme of the heavens, the recently discovered Pluto.

Slowly the nine planets began a majestic revolution around the central blazing sun. Tiny Mercury raced around its luminary like a toy terrier circling a mastiff. Venus and Earth, and the rest followed suit at successively slower paces, until, at a majestic distance, faint Pluto seemed hardly to move at all on its tremendous orbit around the sun. Faster and faster move the globes until Mercury was a thin ring of light, like a stellar pinwheel. Now Pluto's movement was perceptible.

Suddenly Venus wavered in its steady stride and darted outward, almost colliding with the Earth at their inferior conjunction. Mercury, Mars and Earth described strange and unnatural antics in the majesty of the heavens; while even distant Pluto faltered in his tremendous journey.

The lecturer's voice broke, startled by the unaccountable mystery. The lights flickered on and his face was strangely white as he stammered lamely—

"Sorry folks—but the—the projector's out of order."

Laughing and talking, the crowd filed out slowly from the dome. William Jones stood strangely hesitant. For he knew. Knew that not a breakdown of the projector, but an awe-inspiring, an unbelievable alteration in the very nature of light itself, had caused the strange phenomena in the man-made sky!

* * * * *

GORDON WHITNEY, lecturer extraordinary, stood serenely before the meeting of the Ladies' Society for Intellectual Advancement.

"Our topic for today is a truly momentous subject," he began, turning his head a trifle to one side so that his audience would receive full benefit of his really remarkable profile.

"A subject which is the fundamental basis for life as we know it. A phenomenon which controls the mighty system of the Universe with a consummate perfection. In short, the subject of gravitation.

"I have here today an apparatus which accurately and thoroughly demonstrates several of the major points in the law of gravitation." Whitney extended a faultlessly manicured hand, indicating the mechanism on the table beside him. "And to straighten out these points to the satisfaction of all, I think it will be wise to carry out our experiment before continuing with our study."

He turned to the apparatus and picked up two steel balls which lay on the table beside it.

"As you see, one sphere is about an inch in diameter, the other, three inches. Since they are both composed of steel of the same specific gravity, the weight of the three-inch sphere is many times that of the one-inch.

"The mechanism, as you see, is designed to hold the two metal balls at exactly the same height in compartments at the top of the stan . One compartment contains a spring and a horizontal guide. The purpose of this is to project one sphere outward parallel to the floor. The other compartment contains a trap door which is activated by the same release lever as the spring. Consequently, when a ball is placed in each compartment, the spring set, and the lever released, one ball is shot out horizontally at exactly the same instant the other starts its fall to the floor.

"Now to the uninitiated," Whitney continued, placing the smaller globe in

the spring compartment and the larger in the trap compartment, "it would seem that the ball which was released to fall directly to the floor must certainly reach it before the ball with an initial horizontal velocity." He smiled patronizingly at his audience.

"When, as a matter of fact, of course they both hit the floor at exactly the same time—for they both must necessarily have the acceleration of gravity, thirty-two feet per second per second, regardless of the horizontal direction of the smaller sphere.

"And to kill two birds with one stone —or two marbles, in this case—I shall demonstrate the truth of Galileo's famous experiment—that two bodies of different size and weight dropped from the same height will, neglecting air resistance, reach the ground at the same time."

With dramatic deliberation Whitney tripped the release lever.

The smaller sphere flew out parallel to the floor, then curved down in a sudden arc and struck, an easily discernible moment before the larger ball thudded to the floor.

Whitney's smile was suave.

"Release didn't work quite right," he explained. "We'll try it again."

Again and again he tried it—and always the smaller ball announced its victory with a disheartening thump.

Finally, disheveled and utterly bewildered, a sadder but not a wiser Whitney watched his audience file mirthfully from the room. And his profile, his remarkable profile, seemed suddenly gaunt and old.

CHAPTER II

The Sunken World

FAR out in the broad expanse of the Atlantic, a thousand miles west of the mighty Pillars of Hercules, a strange writhing and bubbling tormented the formerly placid waters.

The foment and turmoil grew to cataclysmic proportions. The wind howled in mighty gusts, hurling foam-laden spray like a giant at play. Thunderous waves crashed, then swelled to towering heights only to fall back on the bosom of the sea with smashing force. And deep in the bowels of a tortured Earth, strata after strata of solid rock buckled and groaned and heaved with the pangs of a mighty transformation.

Slowly, above the lashing scourging tons of water, a strange structure pushed its way. Smooth with the artificial evenness of a man-made structure, a great hemispherical dome was growing out of the depths of the fathomless Atlantic.

Gradually it pushed its way into the clean coolness if the salt-flavored air. Soon a mighty curving dome a thousand feet in diameter, anchored to the virgin rock of a forgotten continent, dried its slime-covered slopes in the heat of the blazing sun.

At the base of the mighty dome, massive locks, dozens of feet thick, swung open for the first time in almost two hundred centuries! Air, sweet and fresh, rushed in, filling every corner, pervading every nook and cranny of the great vaulted sanctuary—for the first time in twenty thousand years!

In a great central amphitheater, directly under the highest point of the immense structure, a thousand human beings, tall and spare almost to the point of emaciation, crowded and milled in the grip of a mighty excitement.

They had thin bones and steel sinews that meant not an ounce of superfluous flesh. Their hair was the vivid blazing yellow of dandelion blossoms. Their features seemed cast in an almost identical mold. High broad foreheads, thin high-arched noses, narrow lips set in a cruel even line. Intelligent with the super-intelligence of selective breeding, wise with the knowledge of long forgotten ages,—and ruthless—ruthless with the inexorable pitilessness of a race of rulers!

On a raised dais in the center of the vast amphitheater stood one whose magnificent brow, whose cold calm features and regal bearing proclaimed him ruler even among this race of supermen. He raised a slender hand. The multitude became silent.

"The time has come!" His voice was strange, guttural of tone, with accents reminiscent of words long forgotten, but strangely familiar in the languages of men.

"After two hundred centuries, the people of Atlantis are once again ready to come into their own! After two hundred centuries of waiting, we, a mere thousand strong—all that remain of a mighty race which once built mighty structures, did mighty deeds—are again ready to take back the Earth which rightfully belongs to us!"

The swelling roar of a thousand voices sounded the approval of his words. The leader raised his hand in a quieting gesture.

"Ten thousand years before the Great Catastrophe our ancestors had expanded and spread till they covered the surface of the Earth, a thousand millions strong—subduing and cowing the lesser peoples into peaceful submission. The world was theirs—completely, irrefutably.

"THEN came a day when a great scientist predicted a time when Atlantis would no longer be supreme. A time when Earth would be swept by a change so far reaching, so vast, that its continents would shudder and twist, a time when the waters of the seas would rise and sweep the surface of the world, submerging the vast civilization which flourished on its lands.

"The people of Atlantis, with a great and contemptuous folly, laughed at that scientist. Laughed at his prediction that anything could happen to the chosen ones of Earth. Condemned his theory as utterly groundless and ridiculous. So, with a supreme faith in his prophecy, the scientist gathered together a chosen group, and constructed this great dome, with its intricate mechanisms for producing artificially food and air. For two hundred centuries this has been our world.

"The words of the great man had not been false, as the peoples of Earth realized when it was too late; realized when vast mountainous waves swept over the lands, and entire continents shuddered and sank beneath the sea.

"And so, out of the countless millions who peopled Earth, a thousand Atlantides were left together with a few dull and semi-savage creatures living on the highest peaks which survived the submergence. Dulled with the despair of an existence in a cell-like prison, our ancestors slowly lost their ambitions, their will to progress. They lost the hopes, the dreams, the plans of their fathers, and lived only from day to day with a dull and reasonless monotony.

"They neither followed the carefully planned development which the great scientist had mapped out, nor thought of his hopes that after the Great Catastrophe was over, Atlantis could be raised again above the surface of the water and its people once more come into their rights as rulers of the Earth. They thought not of the great world outside, nor yearned for the knowledge that would enable them to possess it. They simply existed—like the savages who increased and multiplied until now they swarm on the face of the Earth in almost countless numbers.

"At last came an awakening, and our people once again sought knowledge; sought scientific advancement in preparation for the day when Atlantis would again rise above the sea, and her peoples go forth into the sunlight—ready to wreat their rights from the savages who have overrun its lands and seas."

The impressive figure was silent for a moment. Silent with his thoughts of great conquest; of a mighty, absolute power over the world and its hordes of people.

"And now, that day is here! People of Atlantis, we are ready! Ready to claim once again the world that is ours!"

A mighty roar of acclamation swelled to thunderous volume and filled the arena with the echoes of a ruthless people's indomitable determination.

MEANWHILE, in the world of men, scientists and thinkers the world over were busy checking, figuring and rechecking, striving to locate the unbelievable multitude of errors which unaccountably crept into every

process. Research chemists, busy synthesizing compounds of industrial value, were amazed at the results produced by tried and true reactions of familiar chemicals. Equations for the production of various perfumes for Milady's boudoir produced astounding results which varied from substances resembling coral to atrocious putrescent slimes suggestive of long-decaying protoplasm.

Already the world had begun to realize there was something at work far more powerful and infinitely less understandable than the floods, fires and earthquakes which heretofore had been their greatest fears from Nature.

An Austrian newspaper printed scare headlines announcing that the end of the world was close at hand, and quoted a number of astronomers who advanced the theory that the Universe was exploding at a greatly increasing velocity, as proved by recent astronomical observations.

Then next, a series of explosions razed dozens of medicinal drug and cosmetic factories. Pharmacies and chemical supply houses flamed and shot a myriad of brilliant colors into the sky. A rainbow of corrosive burning hues rained down indiscriminately on buildings, streets, and human beings.

Delicate watches no longer functioned. Unaccountably, gasoline was beginning to fail as a motor fuel, and people frantically turned to carts, horses and bicycles to carry them from the fast growing turmoil of the industrial centers.

Mobs roamed like packs of wild beasts, looting and destroying; seeking and fighting for every scrap of food. When granaries and warehouses were emptied of their precious contents, and hunger gnawed at vitals, the old rule of survival of the fittest again came into its own.

It wasn't the fire, the destruction, nor even the hunger that completed the demoralization of the proud rulers of the Earth; it was the utter incomprehensibility of the weird and impossible changes in the very fundamentals of their civilization.

Following close on the heels of the destructive fires came the malignant, soul-chilling ghouls of horrid death—plagues virulent beyond belief, snuffing lives like the dawn's dimming of a million stars.

The Day of Reckoning had come. Whether it was the manifestation of wrath of an angry God or a mere whim of Nature, mankind was being put to the most heart-rending, soul-despairing test since the dawn of time.

CHAPTER III

The Star That Would Not Behave

FAR out in space, two hundred and forty thousand airless miles from the great green globe which lay enmeshed in the web of an enigmatic disaster, a tiny sliver of metal with its two human occupants had for two weeks been coasting toward the silvery globe of the moon.

Entirely oblivious of the strife and turmoil which lashed the surface of their mother planet with strange and absolutely unparalleled potency, Neil Danson and Bert Baker were tense with the excitement of making a safe landing on the great pitted sphere which loomed huge and menacing beneath them.

"Well, Neil," said Baker, close behind Danson, who stood over the control panel with muscles tight—ready to correct any undue roll or movement of the tiny craft as the moon's gravitation gripped them in an ever-tightening embrace, "she looks—she looks—"

Danson nodded. "I know just what you mean, Bert. Take a long look. You're gazing upon the—upon your future home."

Baker was silent. He knew what Danson had started to say. Knew that he meant the cold and lifeless, crater-scarred world was to be their grave! Knew that the prospect for them was utterly hopeless. Stranded, without fuel, and with a limited supply of food and oxygen, it would be only a matter of weeks before the cold and airless satellite would claim the lifeless bodies of two hulks of organic matter entirely

alien to its barren surface as its own.

Queer, irrelevant thoughts flitted through the agile brain behind Baker's elfish face. He reviewed the events that had led to this now-doomed attempt to brave the void to the moon and back . . . He and Danson had both taken their degrees; Danson in mathematics and he in physics. Afterward, because he had money enough to follow his inclinations, and spurred by the recent flights into the stratosphere, he and Danson had designed and built the vessel.

At the last moment, because of a peculiar dark zone around the star Vega, they had included in their very limited paraphernalia a six-inch telescope, to try an observation from the moon unhindered by Earth's thick blanket of air.

Baker was aroused from his reverie by Danson's exclamation:

"The Mare Imbrium—Sea of Rains. A grim satire of a name for the drear and arid expanse of an utterly lifeless crater-dotted plain of ashes and rock. A terrible place to spend the last moments of one's life. But if we want to set this tub down without smashing it to splinters, this is the logical place." He looked over his shoulder at Baker.

"How about it, Bert, old man? Shall we head for the little summer resort of Cassini—just at the base of the scenic Lunar Alps, or shall we head for the more awe-inspiring spot at the mouth of the strait where the Sea of Rains flows into the Mare Serenitatis—Sea of Serenity? You know, Bert, those old boys who named these spots must have had a well-developed sense of humor. 'Sea of Rains flows into the Sea of Serenity'— and all without a drop of water." Danson sighed a trifle wistfully.

"Let's try Cassini," decided Baker. "It sounds like good old Italy—and I've always had a failing for brunettes —with blue black hair and rich olive skins—"

"Quit it!" commanded Danson. "You're making me homesick. Cassini it is, then."

After hours of careful and cautious juggling of rocket bursts from starboard and port, fore and aft, the tiny ship scraped to a perfect stop on the broad expanse of the Mare Imbrium.

TO the left of them, a thousand yards away, lay the deep, broad bowl of Cassini, its depression reaching on and on until its far edge was lost against the great lava fountainlike Caucasus on one side, and the jagged spike-peaked Alps on the other.

"Well, we're here," said Danson, pressing close against the thick glass observation port.

"So what?"

Danson shrugged and gave up his place to Baker, who promptly flattened his nose against the glass in his eagerness to see.

"Marvelous view," complained Danson. "Nothing but rock, rock, and more rock. I have a feeling I'm not going to appreciate our vast estate, Bert."

Baker turned from the observation port. "Your description of the view is a trifle over-enthusiastic," he grimaced. "It's worse than that."

Danson grinned appreciatively.

"Well, Bert, since we've come quite a way to make our little observation, perhaps we'd better get started on it. Jump into your suit and oxygen helmet, and we'll set up the old 'scope on Luna-firma, and see just what the constellation Lyra has to offer by now."

After examining the deep dent in the little ship's side, and the disastrous gash into the starboard fuel tank, the two figures encased in thick protective suits and diverlike helmets looked at each other wordlessly. They turned to set up the six-inch telescope on the pumicelike floor of the great Lunar sea bottom.

Danson focused the 'scope on the bright pinpoint of the first magnitude star, Vega, toward which our sun and its Solar System are traveling. He stood for long minutes, tense and motionless at the eye-piece of the instrument. Finally he turned from the 'scope with amazement written wide on his strong features.

"Take a look, Bert, and tell me whether I'm completely crazy. If I'm not entirely bughouse, Vega is doing something remarkably like the hula-hula!"

Baker squinted through the instrument for what seemed an eternity, then straightened up with an exclamation of wonder.

"Can you beat that! She's wandering around in circles like a lost pinwheel. Maybe the old-timers were right, Neil, and too-close association with old Luna has turned us completely loco!"

Danson shook his head thoughtfully.

"Let's take a look at Polaris and Sirius. And don't forget our next-door neighbor, Alpha Centauri—you know, he's only 4.29 light years away—practically in our laps."

Star after star came into focus under their adjustment of the 'scope, and all were performing the most outlandish gyrations in the grey-black of the heavens. And try as they would, they could find no indication of the strange cloud in the direction of Lyra.

Finally Danson turned from the 'scope and shook his head in despair.

"There just isn't any rhyme or reason to it. Seems like—wait a minute. It just could be that—" He whirled to Baker, almost jerking loose their connecting communication cord. "Damn it, Bert, if we could only get back to Earth!"

"Well," comforted Baker, "you just figure out how we're to do it, and I'll be perfectly willing to trail right along with you."

DANSON stood for a moment, undecided.

"Let's get back to the ship and see if we can't do a little figuring on this," he said finally.

Free from the cumbersome suits and headgear, they stowed the 'scope away in a compartment, and adjusted the oxygenating apparatus.

Neil Danson turned to the instrument panel and examined the port fuel gauge. Its pointer was dishearteningly below the half-full mark.

"Not a chance," he murmured. "Not a chance in the world."

"You mean—in the moon, or better still, in the Universe," amended Baker.

"What do you say we try it anyway?" Danson exploded suddenly.

Baker looked at him searchingly. "What are you talking about?"

Danson waved a hand in an inclusive gesture.

"Well, there's something so utterly screwy about everything—the whole Universe—that I thought maybe if we took a chance and blasted away from here, heading toward the Earth—that maybe—just maybe, something might happen that we—"

"Fine large chance," scoffed Baker. "It's like tossing a coin with Death. If it comes up heads—he wins. If it comes up tails—we lose."

"And what if it happened to stand on edge?"

"If it stood on edge—" Baker paused. "What the hell, Neil. Let's go!"

The two stood tense and rigid as Danson slowly fed throttle to the stern rockets. The discharge kicked up a white cloud of dustlike pumice which fell almost instantly back to the flat surface of the sea bottom, unhindered by the presence of any supporting atmosphere.

Slowly the tiny ship shivered and scraped along the ancient Mare, gained speed, and moments later they were hurtling along, yards above the Lunar landscape.

"So far, so good," muttered Danson, relaxing a trifle.

"But probably not far," said Baker.

But the steady roar of the rockets belied his words. Minute after minute, the two waited for the inevitable dooming sputter that would mean the last of their fuel. Minute after minute the powerful drone of the stern discharge continued with unabated force.

Suddenly Danson turned to Baker with an exuberant shout.

"Bert! Look!" He pointed to the instrument panel. "We've already attained a velocity greater than the 1.2 miles per second we need to lick the moon's gravitation! And the crazy thing about it is—I've only got the throttle in the third notch—while normally I'd have to have it over about twenty to attain the same acceleration!"

Baker jumped to the panel. He straightened up.

"Maybe—just maybe," he said slowly, "that nickel stood on edge!"

CHAPTER IV

The Deserted City

BACK on the great green globe toward which the tiny rocket's nose was pointed, pandemonium reigned.

In the weeks following the beginning of the Great Change, the overwhelming metamorphosis of every familiar thing had swept man's reason perilously near the brink of gibbering, chattering bestiality.

Then, slowly the resiliency of human minds began to return a degree of sanity to the strongest of the roving, plundering animal-men. Minds once again began to consider something besides the gnawing of hunger, the urge of sex, and the fear of the unknown. Men began to wonder, and to probe at the meaning of new and strange phenomena; began to try to revise old ideas to fit the new conditions.

And the task before them was pitifully overwhelming. On all sides they were confronted with ridiculous and absolutely impossible destruction of all normal and familiar things—to be replaced by phenomena which staggered the strongest reason.

There were strange, distorted miracles. Water in rivers and creeks seemingly flowing determinedly back up to its source; short violent showers of almost scalding rain; the familiar yellow-gold of the sun changed to a color which defied human attempts to classify it; gravitation warped and altered until huge men could vault with ease over low buildings, while the smaller animals, like rabbits and mice, were held in a gravitational grip so strong that they lay in a deep coma. Mighty machines twisted and tortured into fantastic shapes; wheels warped and became disfigured until they were outlandish travesties. Strangest of all, there was the utter impossibility of reconciling even the simplest of mathematical formulae.

And in the straggling clusters of bewildered and dazed remnants of mankind, still clinging near the scenes of their former omnipotence, there came strange rumors and queer tales — of tall, thin, yellow-haired strangers who roamed the country with strange weapons, commanding and herding the little groups to do their bidding.

Talk filtered through, that the men with the golden hair were gods who resented the attempts of mankind to inquire into the scientific reasons for things only the gods should know; resented the past civilization which man had wrested from Nature—and had brought about the Great Change to punish man for his temerity.

Slowly, under the sway of the insidious rumors from the tall yellow-haired strangers, the more impressionable began to follow the suggested line of reasoning. They sought to convince the strong-minded, more stubborn individuals that what the gods said was right.

Slowly there developed two factions. One was in favor of the progressive analysis of the Change, and the attempt to formulate a new set of sciences and knowledge to wrest once again a civilization from the covetous grasp of Nature.

The other maintained that knowledge and science had been responsible for the calamity which had almost destroyed mankind; for, they explained, if civilization had not been highly mechanized and almost entirely dependent on scientific achievements, the Great Change would have made little difference in the lives of men. For this reason they urged that knowledge, research and invention, be made things to be shunned and despised.

Bitterly the exponents of each argued their cause with all the eloquence at their command. Fanatics sought to impose their creed upon all. If not by convincing them by argument, then by torture and death. Martyrs were burned at the stake, beheaded, or their bodies left hanging from trees and poles in mute testimony that man again sought to compel others to think his way.

Slowly the factions separated, drew apart into tribes, constantly at war with each other; pillaging, plundering and striving to annihilate the opponent. And with the groups which

strove to stamp out man's inherent desire to learn appeared tall, yellow-haired, hawk-visaged strangers with queer and fearsome weapons—weapons that blasted men and rock alike—into absolute nothingness.

Gradually, the exponents of a material, non-reasoning existence, championed and aided by the yellow-haired gods, drove the stubborn but helpless believers in the value of knowledge back in an ever broadening battlefront.

Back, relentlessly back, the knowledge-seekers were driven until, in small groups, they sought refuge in small towns; on board huge ocean liners drifting aimlessly in harbors. Even in abandoned mines, subways and in sewer systems.

HIGH above the Earth, by sole virtue of an incalculable freak of the Great Change, sped a tiny silver bullet with its two human occupants.

Entirely unaware of the disastrous holocaust which had swept Earth, Danson and Baker were frantic with joy at once again seeing their home planet, yet dazed and utterly bewildered by the fact that an amount of fuel less than one-tenth the calculated necessary amount had brought them miraculously back on the long journey from the moon.

Slowly the tiny rocket circled down and down in an ever tightening spiral. At last, with a final cushioning burst of the forward rockets, it came to a sliding stop on Chicago's great municipal airport—after the most phenomenal journey ever attempted by man.

With almost frantic haste, the two adventurers unscrewed the port and crawled from their cell-like quarters. They looked curiously around the deserted landing field, then looked at each other in wonder.

"Well!" said Baker, "looks like we're about as welcome as a snow storm in April. Not a soul on the place."

Danson nodded.

"There's certainly something peculiar about it. Not even Donovan and Larsen here. If there weren't something terribly wrong, I know our old pals would be on the spot to welcome us, at least."

Together they started across the field toward the municipal offices and hangars.

"Bert!" Danson stopped suddenly. "Do you feel the same way I do—as though you were walking on air—just as if Earth's gravity had suddenly been—"

"Right," said Baker. "But look out there!"

Danson's eyes followed Baker's gesture.

Out in the broad avenue beyond the airport he saw a great and tangled confusion of what once had been pleasure cars, motor vans and trucks. The frames were twisted and warped as if some giant hand had crumpled them in a single effort. And, among and around them, were dark blotches on the grey of the pavement. Danson shuddered, while slowly there came to his nostrils the hideous, nauseating odor of long-dead human flesh.

His eyes turned to the skyline of the great city. Gaunt and twisted skeletons of steel were mute evidence of the ravaging fires which had gutted the mighty buildings. And nowhere—absolutely nowhere, was there any sign of the city's former teeming millions.

"God! Neil—what's the matter?"

Danson shook his head bewilderedly and drew a hand across a suddenly moist brow.

"I don't know, Bert." He turned to Baker in sudden determination. "Let's get to the Midwest research building right away. I'm not at all sure, but I may have an idea what all this might mean."

Together they wound a tortuous way through the terrible shambles of the great city's streets. Disaster on every side met their horrified gaze. And the air was thick, appalling, with the choking odors of the bodies that littered the way.

At last they stumbled into the huge brick structure which housed the research laboratories of Midwestern University. Somehow the building had escaped the fire and destruction which had reduced a full half of Chicago's mighty buildings to twisted skeletons and tremendous piles of brick and rubble.

BUT its interior had not fared so well. Grotesquely distorted and broken piles of machinery and apparatus lay in hopeless confusion in every room. Hopelessly Danson led the way from one laboratory to another.

As the two pushed open a door which read Atomic Research Laboratory, two figures at the far corner of the room started up with frightened faces from the apparatus over which they were working.

Danson took one look at the gaunt but still rotund face of the stouter figure, and the lean, bronzed features of the other.

"Larsen — and Donovan! By all that's holy!" he shouted.

The eyes of the two opened wide in amazement.

"Danson and Baker!"

A moment later the four men were wringing each other's hands and all talking at the same time.

"We gave up hoping for you back, after the — Great Change came," said Larsen, after the four had quieted down enough to exchange information on the more than eventful happenings of the last terrible month.

"So did we," said Baker, drily.

After the two had told of their near-fatal trip and the miraculous freak which had brought them safely home, Donovan and Larsen had given them a resumé of Earth's pitiful demoralization by the Great Change.

"It's all been like a terrible nightmare," Donovan concluded. "Like a dream, when you seem to be talking to some one familiar—and suddenly he turns into a tiger or a sphinx. You think you are running away from some danger with all the speed of an Owens, and discover that you aren't moving a foot. There's something so completely bewildering about the disruption of all natural laws, that while you're awake, things seem even worse than your nightmare. It's hard to bring your mind to focus on any one phase of the thing."

"You know," Danson began, "I don't believe that the yellow-haired Atlantides are at all responsible for the Great Change. I believe that, with their su er-science, they simply anticipated it, and are taking advantage of it to conquer Earth."

"Very nice," scoffed Donovan. "We'd all like to believe that they're not absolutely invincible — as they most certainly are if they have caused all these impossible metamorphoses. But if *they* didn't cause them, who did?"

"Mother Nature," stated Danson quietly.

"Without any help?"

"All by herself. And I'll bet my shirt I know how it happened."

He turned to Larsen, the astronomical expert of the group.

"The sun and its planets, that is, the Solar System, and in fact the sun and the entire group of stars constituting our Universe are moving constantly through space, are they not?"

"Right," said Larsen.

"They travel probably billions of terrestrial miles a year, don't they?"

"Correct."

"Well, here's the idea: Let's compare the portion of space through which our Universe or Galaxy has been traveling during the last few thousand or million years, to America. We're driving along in an automobile keeping to the right according to the law—which, by the way, in several other countries would be exactly the unlawful thing to do. We stop in one town and park parallel to the curb. Along comes a policeman and tells us it's their city ordinance that cars park diagonally. Remembering this, we proceed to the next town and park diagonally—"

"TEN bucks for over-parking," said Baker.

—"Along comes another policeman and tells us it's their city ordinance to park parallel to the curb. And there you have it. We're right according to one set of laws, but when we apply the same laws in a different part of the country—it just doesn't work."

"Uh-huh!" said Larsen. "You mean that it's ossible that space is not — homogeneous. That is, perhaps it is endless, but consists of different zones or bands — like the lines of the spectrum."

"And in one zone," went on Danson, "certain laws are true—for instance: that a straight line is the shortest distance between two points. In another, using the old fallacy as applied to a sphere, a curved line may be the shortest distance. In one zone, three plus three may equal six. In another, the answer will be seven."

"Impossible," scoffed Donovan. "Mathematics is an exact science. Using a certain set of units throughout, the answers must be always definitely relative."

"True enough in *one particular zone,*" said Danson.

Donovan grunted unintelligibly.

"How about the impossible things that have happened to all our natural phenomena?" Danson pointed out.

"The Atlantides could have—"

"Atlantides, nothing! If they have the absolutely unlimited power the Great Change would indicate, why haven't they simply wiped out Earth's inhabitants with one tremendous miracle? At least, for the sake of my arguments, let's assume that my hypothesis is correct—merely as a basis from which to start."

"And after we start, then what?" asked Larsen.

"The really momentous question just now," said Danson, "is whether the change from one zone to the other is complete—or whether we are barely on the dividing line between the zones and the changes have only begun. If that is the case, what can we expect in the future?"

"A nice padded cell," said Baker. "And by the way, that 'Zone' business gives me an idea. Look—is there any reason why errors we've made in the past, were errors at all? Why couldn't they simply have been a misapplication of primary zone laws to a wisp, or narrow band of an alien zone? If we're entering a new spacial belt where the old laws don't hold true, is it unreasonable to suppose that we've crossed many strips of such bands or zones in the past? And isn't it possible that evolution is the result of Man's passing through a series of zones?"

Donovan laughed.

"After all, why not?" defended Larsen. "Isn't that by far the best explanation you've heard for the innumerable happenings in the past, which no one has ever been able to explain satisfactorily?"

"Sure," said Baker, smiling at his champion. "What about all the queer things that have happened; the sky's raining down all sorts of frogs, toads and snakes; the strange lights which no one could explain, and a thousand stranger things? And how about the miracles in the Bible, and the strange things the East Indians have done? How about the peculiar happenings of only a few months ago—airplanes by the dozens, crashing here, there and everywhere, and no one knew why?"

"Might be something to it, at that," admitted Donovan. "If so, we may be in for a new age of miracles—greater than those we've already seen!

"Larsen and I have been working on something," Donovan went on. He gestured toward the apparatus in the corner of the room. "We're trying to work out some kind of a weapon with which to combat the Atlantides. But we've been so hopelessly handicapped by the lack of any rules or laws on which we could base our experiments that we haven't progressed very far."

NEIL DANSON nodded. "The first thing to do is to work out a system of laws, and most important, a set of mathematics, which will suit and fulfill all conditions of the new Zone." He turned to Donovan. "Do you think we are safe here? How about the Atlantides?"

Donovan shook his head.

"I'm almost positive they won't bother us. You see, there are evidently only a few of them, and after once having evacuated a city to their satisfaction, they don't bother with it any more."

Danson nodded with approval.

"Then we're all set. And I think we'd better get to work right away, trying to work out a new mathematics."

It was like a blind man hunting for the proverbial needle in the haystack. They had nothing, absolutely nothing on which to base their fundamental

concepts. It was like trying to solve a difficult puzzle written in an unknown language. Day after day, the four covered reams of paper in their frantic efforts to find some faint hint, some truth on which to base their work.

One day Danson leaned back from his work in despair. His eyes fell on the tortured and twisted wheel of a wrecked static machine in one corner of the laboratory. His eyes opened wide, and with sudden determination he returned to his work.

Moments later, he sprang to his feet with an exclamation.

"I've got it!" he shouted.

"Look!" he said, pointing to the twisted wheel. "It's evident that the relation of the radius to the circumference of a circle must have been one of the things affected by the Great Change. I've determined that Pi, the relation of diameter to circumference, is no longer 3.1416 plus, but almost twice that!"

"You have something there, Neil," said Larsen. "Let's get going on it, boys."

And slowly they made headway. They found that now, instead of a zero and nine digits; two abstracts and fifteen digits were required to suit the mathematical complexities of the new order.

In the midst of evolving the new mathematics, Donovan threw up his hands in despair.

"It's like having a nightmare during a somnambulistic swim in a sea of alphabet soup," he wailed. "I know—or I *knew* that two apples plus two apples equals four apples. Fair enough. But now you're trying to tell me I can't use two as a definite digit of double unity!"

Danson smiled. "Look here," he said. "In the old order of things, if two apples and two apples equaled four apples—what did two apples plus two oranges equal?"

"Four, of course," said Donovan.

"Four what?" asked Danson.

"Four—well," Donovan threw up his hands in despair. "I have no idea."

"Another anomaly of the mathematics of the days before the Change," Danson continued, "was the lack of agreement in corresponding operations. For instance, if X equals 2, and Y equals 4, then XY equals, or equaled, 8. But if we write the digits representing XY thus: 24, we no longer have 8, but three times that amount. Of course all this is fundamentally a circumvention of the real issue, but it serves to illustrate my point that mathematics is not as stolidly immune to changes in its basic concepts as you seem to think."

"But that's simply a way of algebraically expressing a multipication, which does not correspond with the arithmetical form at all," protested Donovan.

"Exactly!" smiled Danson. "Just what I wanted you to say. Now is there any reason why a change in the fundamentals of physical laws and phenomena couldn't compel us to use an en rely different set of mathematical symbols and operations to meet the new demands, just as we did in the change from arithmetic to algebra?"

DONOVAN looked rather puzzled even after the explanation.

"Another condition for which the old mathematics had no provision can be illustrated in this way," continued Danson. "We take a certain unit of measurement, an inch, for instance. According to our old system of mathematics, that inch could be divided into an infinite number of fractions. Now if a snail started to traverse that inch, he would cover an infinitesimal fraction of that distance, then another and another. If the number of fractions were infinite, as the old mathematics maintained was possible, it would take the snail an infinite time to travel that distance.

"Actually it does not. Consequently we conclude that the mathematics was at fault in maintaining that there are an infinite number of fractional distances. Do you follow me?"

"I'm struggling," moaned Baker, "but I'm afraid I'm like the snail—I'll never arrive!"

Gradually the four friends perfected their new mathematics with its be-

wildering array of new numbers and theories and laws. Slowly they applied their knowledge to physics and chemistry. And in time, with parts salvaged from an almost inexhaustible store of pre-Change apparatus, they constructed instruments and machines which functioned perfectly under every condition of the new Zone.

Selecting physics and chemistry as the two sciences with the most possibilities for aiding them in their efforts to throw off the despotism of the Atlantides, they divided into two groups; Baker and Danson working with the physical phenomena, and Donovan and Larsen turning their efforts toward the New Day chemistry.

Little by little, each group made progress; day by day they found new and strange phenomena—made possible by virtue of the changed laws.

Meanwhile, rumors seeped in through the outlying groups of hidden "Believers," with whom Larsen had maintained contact. He learned that the Atlantides were building huge fortresses, protected by tremendous replicas of their atomic projectors, and surrounded by a protective screen which no material substance could penetrate. These structures were at a vantage point near every major city of the world; and in each of the guardian towers was stationed one of the gaunt yellow-haired strangers.

CHAPTER V

The Challenge of Atlantis

GRADUALLY, the little groups of Believers, in their hidden retreats, began to contact other groups, and to combine into a secret brotherhood under the direction of the four friends. Secretly, as Larsen deemed it advisable, they were informed of the progress made in the laboratories.

Hope began to run high in the breasts of millions of human beings, driven relentlessly into hiding in dim, dark places; hope engendered by the encouragement passed on to them through a vast grapevine system from the four men hard at their work in an effort to bring freedom to the fore; hope that some day Man might throw off the rule of a tyrannical oppressor and once again seek knowledge and advancement.

Faced with the tremendous task of working out the salvation of an entire world, the four men labored night and day in their efforts to develop some means of combating successfully the almost invincible infra-atomic projectors of the men from Atlantis. And day after day, they were weary and disheartened with absolute failure.

It was utterly useless for them to attempt to develop atomic disruptors similar to those of the yellow-haired despots, for the Atlantide scientists, knowing the method of inciting the atomic disruption, would necessarily have a means of dissipating the force, and consequently would be able to shield themselves effectively from any attack of that nature.

Larsen finally shook his head in despair.

"Neil, I don't know how we can do it. Donovan and I have been working on explosives, poison gases, liquid fire —in fact practically everything included in the category of chemical weapons, and we haven't developed a thing which would stand a chance of penetrating their protective screens."

Danson smiled broadly.

"Baker and I have been keeping a little secret," he said. "We haven't bragged about it, because we aren't positive yet that it will work; besides, we really haven't any thing to brag about—it was all Nature's idea in the first place."

Larsen looked at him queerly.

"I'd appreciate it if you'd quit talking in riddles and tell us what it's all about."

Danson grinned. "It's this way. Baker and I started out in the attempt to develop some atomic or sub-atomic contrivance with which to challenge the Atlantides. But it didn't take us long to decide that they had probably mastered every item in that field, hundreds of years ago. You see, they had predicted and were ready for the Great Change.

"For a long time we were in the same boat you are. Couldn't figure any possible way of beating the strangers at their own game. Finally we started inquiring further into our Zone theory of the Cosmos. Gradually we came to understand that there are an infinite number of zones, or bands, possible. And in that infinite number of zones, there are possible an infinite number of variations for every natural law and phenomenon. That is, the metamorphoses and mutations of our primary or former zone laws, produced by our present zone are by no means the only changes possible.

"In other words, while Pi, in our primary zone was 3.1416 plus, and in our present zone of the Great Change is approximately 6; in another spacial band it might be 10 or 50 or a thousand!

"So, Baker and I, working along this trend, evolved the theory that each zone or band, with its varying laws, is caused by a different warp or different degree of spacial curvature, in each case. Following this theory to its logical conclusion, we determined the type and degree of special warp necessary for the producing of any certain change in any natural law or phenomenon!"

"Whoa!" commanded Donovan. "I'm way behind you."

DANSON laughed. "We'll put it like this," he said. "We'll take one single law and follow it through. There was a law in the days before the Great Change that stated in effect: 'For every action, there is an equal and opposite reaction'. Now it so happens that this law has been affected very little by the Change. Almost all our other laws have been affected to a considerable extent, but, by mere chance, the type and degree of spacial warp in this zone has not changed that particular law.

"And there we had it. If the Atlantides foresaw the Great Change, and were able to prepare for it, they must have known what changes it would bring; knew they need not prepare for any change in that one law."

"I'm beginning to see a great light," nodded Larsen.

Danson smiled. "So, if that was the one change for which they did not prepare, that was the one change we most certainly should try to produce!"

"And we have—that is, theoretically; but it can and will be done in practice. We have determined the formula of the special warp necessary to produce a change that will cause every action to have an opposite reaction of *a thousand times the energy of the original action!*"

"Whoa again!" said Larsen. "You're affecting the law of conservation of energy, also."

Danson nodded. "That is why it was really difficult—working with the two variables; but as I said, we have worked out the formula for producing that effect, and I hope in the near future we will be able actually to produce it."

The months that followed were busy ones. Means of communication were developed, and the brotherhood of the Believers, the world over, was slowly brought into the secret of the great plan. Gradually but surely the four friends were solving the difficulties of their plan of procedure.

They designed and constructed a powerful new type four phase generator which they powered with a simple Nitrone turbine. The output from the dynamo led to a series of magnetized alloy mirrors of varying curvatures.

The theory of the apparatus was that the energy of the four phase generator was changed and altered by the magnetized reflectors into the primary force responsible for the phenomena of magnetism. The number, kind and degree of curvature of the magnetic reflectors determined the type of spacial warp to be produced.

The trouble lay in the fact that the apparatus would necessarily be destroyed by the very change it would produce. There would be only an infinitely short time during which it would function. Then, like Frankenstein, it would be destroyed by the thing it created.

In preparation for that single split second, the brotherhood throughout the world was informed of the plan, and each group was carefully coached

for the part it was to play. At a certain given time, as determined by astronomical and solar observations, a group of Believers would advance on each of the thousand fortresses, each housing a flaming-haired Atlantide.

At the exact time agreed upon, they would, by one means or another, provoke a fusillade from the infra-atomic projectors of the Atlantides, and reaction would take care of the rest.

At last the zero hour approached. A thousand leaders threw up their hands and shouted out the long awaited message:

"The time has come!"

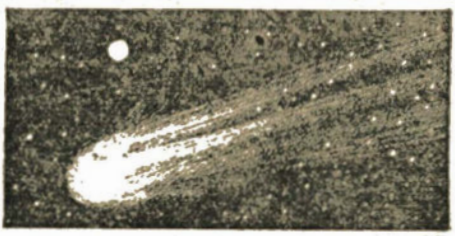
A MILLION lion-hearted men raced from their hiding places and thronged upon a thousand castles of tyranny, ready to sacrifice their lives for the future of their race.

A thousand fiends ruthlessly turned the great disruptors on the charging hordes.

Then a tiny switch in a far-off building closed with a faint click.

A thousand guardian towers, manned by a thousand yellow-haired despots—cracking the whip over a billion Earthlings, were blown with a strange soundlessness into an infinity far more remote than the Cosmos' furthest nebulae—an infinity existing solely in a mere wisp of a space warp.

Atlantis, thrust above the waters by a phenomenon its people had anticipated, was no longer a menace, due to a phenomenon its race had *not* anticipated.



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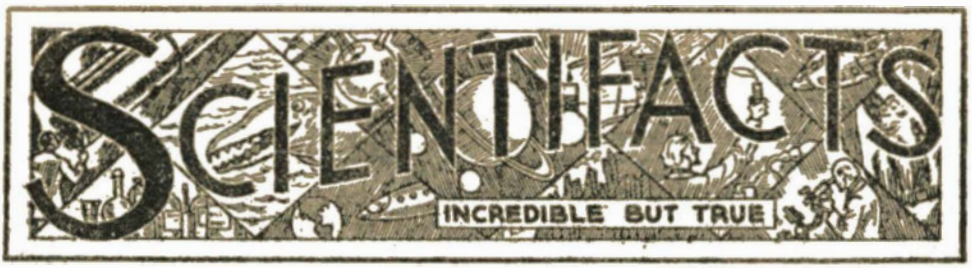
THE INFINITE ENEMY

A Novelette of a Lost Universe

By JACK WILLIAMSON



A BRAND-NEW, FASCINATING FEATURE
By J. B. WALTER

ARITHMETIC OF THE INFINITE

ALDOUS HUXLEY once said that if six monkeys were set to strum unintelligently on typewriters for millions of millions of years, in the course of time they would be bound to type out the contents of all the books in the British Museum.

The Burroughs Adding Machine Company has calculated that, with the twenty-six letters in the English alphabet, there are 403, 291, 461, 126, 605, 635, 584,000,000 possible combinations of letters. But this is only the number

of combinations obtainable with the letters when each letter is used but once. The combinations are infinite when one considers the need for the formation of words such as "abracadabra," where the letter "a" is repeated four times.

The chance of a monkey writing such a word as "pseudoproantidisestablishmentarianism," a perfectly logical word, is virtually nil. And what is to prevent the monkey from striking the letter "a" millions of times before he starts on the letter "b"? With the standard typewriter keyboard, disregarding the shift lever entirely, exactly 1,405,006,117,752,879,898,543,142,606,244,511,569,936,384,000,000,000 combinations are possible.

When one considers the thousands of words that make up our English language and the possibility of placing the words in a certain fixed order, the problem no longer presents the same aspect. While it is true that the number of words is finite, the number of combinations, when one considers the typewriter keyboard and the number of words that can be written, is infinite.

Therefore, Aldous Huxley's statement means nothing. It resolves itself into the task of trying to solve an infinite problem in an infinite length of time.

ALL THE GOLD IN THE WORLD

ALL the gold mined since Columbus discovered America would make but a forty-one-foot block! According to Professor W. Harvey Emmons, geological authority, all the gold produced by the world since 1492 comes to a total of 1,194,913,216 ounces. At the present price of thirty-five dollars an ounce, this would fetch $41,821,962,560. If all this mass of gold were still in existence and all cast in one lump, it would make a cube only forty-one feet on edge.

Of the gold produced between 1492 and 1935, less than ten per cent was obtained in all the time from 1492 to 1800. During the nineteenth century, 31.3 per cent of the total was added, and in the first thirty-five years of the twentieth century all the rest, nearly sixty per cent, came out of the earth.

THE LIGHTNING CALCULATOR

A ONE-TON machine that in a single action can solve nine simultaneous equations with nine unknowns so complicated in form they might well require days of computation by trained mathematicians has been de-

veloped at the Massachusetts Institute of Technology.

Known as the simultaneous calculator, the machine is the product of three years' research. The equations solved by this machine occur constantly over a wide range of engineering and scientific analyses. Although the calculator was originally designed for

the solution of problems in civil engineering, such as those involved in the construction of skyscrapers, it is expected to prove equally useful in such diverse fields as nuclear physics, geodetic surveying, genetics and psychology. The machine can solve an equation for even more than nine unknowns.

The machine weighs approximately two thousand pounds and has more than thirteen thousand separate parts, including six hundred feet of flexible steel tape and almost one thousand ball-bearing pulleys. A single movement of the mechanism performs automatically in a few seconds, computations that might take days by ordinary methods.

NEW SENSES ARE POSSIBLE

FOR centuries scientists have been asking themselves whether it is not possible that, outside of our five senses, there could be still higher senses. We know, and so does every entomologist, that many insects have senses of which we humans have only the slightest notion. For instance, you may take a female moth and enclose it in an absolutely air-tight container. The outside of the box and the person handling it can then be sterilized in such a manner that no other moth could possibly, by means of the sense of smell, communicate with the imprisoned moth.

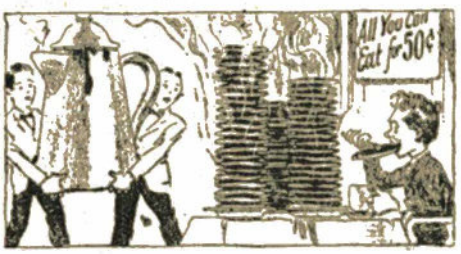
The original container can then be placed into other containers to make sure that no sound can possibly emanate through all the different walls. But if the container is transported to a place where male moths abound, they will immediately become attracted to the container by some sense of which we have no knowledge today. That this sense is in all probability a vibratory one is conceded by all authorities.

THE STARVATION LIMIT

STRANGE and interesting is the variation in lengths of time during which members of the animal kingdom can subsist without food. A bird can live without food for nine days, a man twelve, a dog twenty, a frog three hundred and sixty, a tortoise five hundred, a snake eight hundred, a fish one thousand, and a bug one thousand two hundred!

A SUPER-APPETITE

TRY to imagine a boy weighing one hundred and twenty-five pounds eating for his breakfast two hundred hotcakes, five gallons of syrup, six dozen scrambled eggs, five pounds of bacon and fifteen gallons of coffee! If this seems like an impossible appetite, consider the food consumption of yeast. Under ordinary manufacturing conditions, during a twelve-hour period, one hundred and twenty-five pounds of yeast will consume a ton and a half of food dissolved



in seven thousand gallons of water. It also uses air at the rate of one thousand cubic feet a minute. In twelve hours the one hundred and twenty-five pounds of yeast will have grown to two thousand pounds.

The reason for this is that yeast reproduces by budding. In other words, a small bud appears on the side of the yeast cell and it continues to enlarge until it has nearly attained the size of

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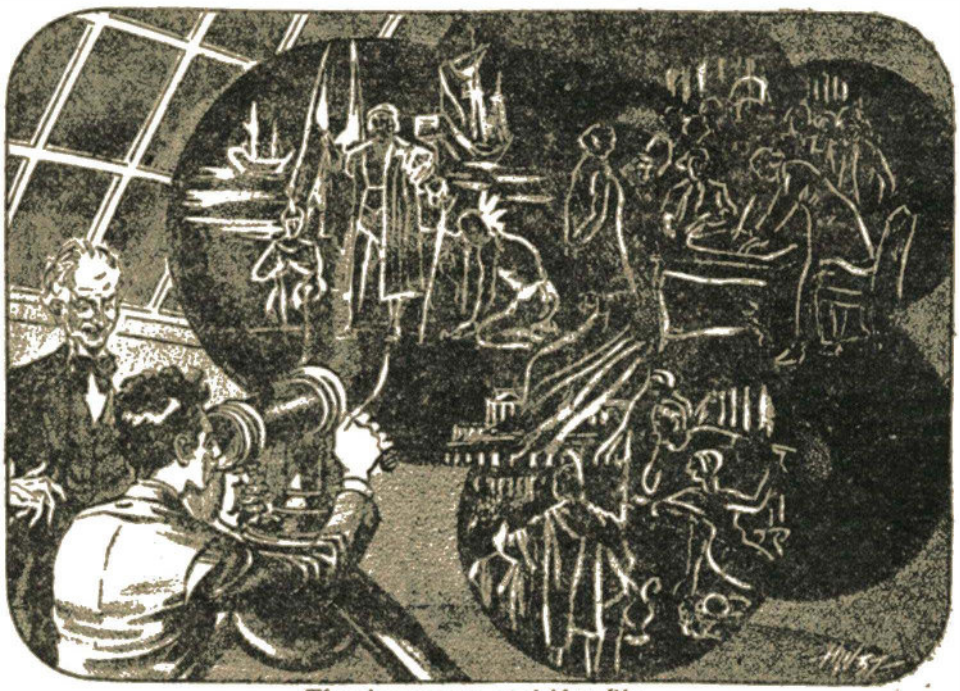
Past, Present and Future Merge Into One When a Scientist Probes the Secrets of Space!



The pictures were as vivid as life

THE CHANGER OF HISTORY

By ALEXANDER SAMALMAN

Author of "Across the Table," "The Last Straw," etc.

Tuesday

I AM not a sentimentalist. My world is the world of science—of material science; my religion is the worship of the tangible and touchable. Ever practical, I was, even in childhood, free of all day-dreams and wild imaginings. I say this here to show why you *must* place the utmost credence in what I have to tell you.

At school I was best in those subjects that require a down-to-earth attitude. I reveled in mathematics. I could tell you to the smallest fraction of an inch, the height of a building, the capacity of a box, the length of a train. I had an uncanny ability to discover X, the unknown quantity, in any equation. To me that X represented the mysterious, the imaginative element in life.

Yes, I had one or two lapses into pure speculation. No youth can escape the influence of two or three of the better-known philosophical literary works, and the *Rubaiyat of Omar Khayyam* exerted a strange fascination over me. Not that I went soft over the sensuous beauty of the lines. Oh, no. Beauty only begins to have meaning for me now, when—well, no matter.

The *Rubaiyat* was to me something

far different from what it is to most. To me it represented the unknown X. I wanted to probe the secret, make X emerge as something that I could touch. When I read:

The moving finger writes, and having writ . . . and so forth, I can't remember, but the general idea is that not a word can be changed in the manuscript of life. What has once happened, stands forever, and cannot be altered.

Now, I knew that whenever I added a column of figures and made an error, I could go back to my work, discover the mistake, and correct it. Why couldn't events of the past be changed, corrected, so that the total, which is the present, could also be altered to suit? Thus the sorry state of the world could be improved by shifting past events around to make the result more perfect.

Don't laugh! Don't shake your head! I can just picture your grinning at me—and I could strangle you for it! Oh, the anger that wells up in me when I am told that this is an impractical, incredible idea! What do most people know about impracticability and incredibility?

Ha e you ever stood in a scientific laboratory and seen the most impractical and incredible things happen right before your eyes, really perfectly natural things that nobody could believe in if years of experimentation had not proven them so?

Believe me, one does not have to be imaginative and a dreamer in this world in order to see and think the impossible. Those who probe into material things with thoroughness are more acquainted with the impossible than those others who never see miracles because their minds are always in the clouds.

Yes, I am level-headed. My realm is that of the true and the exact. If the objects in my realm insist upon wea ing fantastic patterns of their own, this is none of my concern. It does not set me off into poetic rhapsodies. I simply observe the phenomena, and believe everything that can be proven. Nothing else.

I am tired. It is so difficult, trying to make myself understood. Not that your opinion, or anyone's can matter in the least to me now,—but I want someone to carry on my work . . .

Wednesday

THE past exists. There is no question of that. I say this in a scientific, prosaic spirit.

Our conception of time may be all wrong. I don't know. According to Spengler, the ancient Greeks thought of all time as one parallel unit rather than as a progression of events. All things, past and present, in their philosophy, were happening at one and the same time. While you are reading this, many things are happening—happening right now, at this very moment. Washington is crossing the Delaware. Lincoln is freeing the slaves. Napoleon is meeting defeat at Waterloo. Pasteur is bending over a test-tube.

At this very moment—yes, *now*—Paul Revere is sounding his warning: "The Redcoats are coming!" And in a quiet study, Charles Dickens is creating his immortal characters. And Shakespeare is upon the stage of the Globe Theatre.

Let's put it this way—time is concurrent, rather than continuous. Do you get my meaning? Everything is happening *now* but the events are dispersed over a vast area. And man's vision, unhappily, is limited to a narrow range. But the past still lives; the present has always lived; and the future is somewhere, far away, but happening now! If we could see *far* enough we could see the future. Men have had glimpses of the future, and were called mad . . .

Thursday

IT was on a foggy day in late September that I met the person who was to change my whole life.

I was working in a laboratory at the time, experimenting with elementary stuff that earned me a living. Often I put in fourteen or sixteen hours a day. I ate little, slept restlessly, and never had any amusements to speak of.

I never cra ed a more exciting life, however. Observing natural phenomena was meat and drink to me. I never wanted any other outlet. Perhaps I would ha e been better off to continue to this day, in my little laboratory,

working for myself, making my own rules, occupying myself as I wished and gaining a pittance by preparing specimens and charts for other scientific workers. However, that was not to be.

Please bear in mind that when I tell this story in chronological order, I am merely responding to habit and adopting a convention of narrative. Actually, I do not believe there is any such thing as chronological order. Everything that has ever happened to me is happening now. Somewhere, I am still in the past. Only yesterday, as a matter of fact, I looked in upon myself as I was then. Yes, I, Alvin Wright, changer of history—for I proudly call myself that—yesterday called upon Alvin Wright, young biologist. It was a pleasant enough visit. True, we are separated by several millions of miles, but we can see each other occasionally. That is, I can see him. He has not yet—and I shudder at that word "yet," which indicates a chronology in which I place no belief—he has not yet, I say, learned how to see me. Perhaps I can help him . . .

But I started to tell you about Professor Frost, the man who was to change my life. I was working in my little laboratory when I felt a presence in the room. Suddenly the experiment upon which I was concentrating seemed trivial. I looked up and saw a wizened, wrinkled little man standing in the doorway, grinning at me.

"How did you get in?" I asked.

"Oh, I have a key to this place," he smiled. "It used to be my own laboratory, once—"

Somehow I did not think of him as an intruder; his presence seemed perfectly natural. It was as if he had always been there.

"Was your work similar to mine?" I asked.

"In a way," he answered. Then he grinned that sardonic, yet friendly grin again. "I used to study little things," he went on. "I believed with the poet that all civilization could be grasped if one understood a single molecule of matter thoroughly." He stopped, looked around the laboratory, a little smile on his lips.

"But now?" I urged, suddenly eager to know more about this man.

Professor Frost shrugged his shoulders. "Now my province is—the sky!" he said. "The vast illimitable spaces! The stairways and balconies of heaven!"

I stared at him, fascinated; a strange prophetic excitement gripped me.

"Do you know," he went on, "that there are stars so far away from earth that it takes thousands of years for the light from them to reach this planet? Think of it! There, in the neighborhood of those distant stars, up there, may be found light waves from earth—the light waves depicting incidents that happened here thousands of years ago. Up there we find the truth; we see the falsity of the rumors and the legends that are history—the truth of history written in light waves. . . .

"Those miraculous light waves up there that never perish hold the records of mankind's history. That is my work now—I am seeking the keys to those records!"

I spoke then:

"Perhaps—perhaps these light waves are even more miraculous than you dream! Perhaps they are not mere recordings—perhaps they are living actualities! Perhaps the men of ancient days are as real and alive today as we ourselves?"

Professor Frost stared at me a moment, a strange light in his eyes. Then, without a word, he left my laboratory.

Friday

MY vanity was flattered when I discovered Friday why Professor Frost had sought me out. He came to see me several times—appeared unannounced and after a brief conversation generally left as abruptly.

Then, one day he told me that he had heard I was an exceptionally conscientious and able research worker, and that he needed help on a machine he was perfecting. Would I come with him to his home and inspect it?

I would and I did.

In making this record of unusual events, I am constantly finding it impossible to give you an adequate idea

of the magnitude of these things that changed my whole life. I wish I could take you by the hand and lead you, as Professor Frost led me, up that narrow winding staircase, to his laboratory.

After climbing for what seemed an incredibly long time, we came to an observatory dome. It was completely equipped with the latest scientific devices and instruments.

There was an object that resembled a telescope, yet it was not a telescope. It was black, made out of material I could not identify. It was like a long horn with many twists and turns in it.

Professor Frost commanded me to look through it. I did, and saw only blankness.

"What is it?" I asked, curiosity devouring me, but beginning to wonder if this little man was a lunatic.

He said, "You see nothing now, but you will after your eyes become accustomed to the machine. As for its name—it has none, yet. It is made of materials found only in the heart of Africa. I spent years combining them to get the proper result. The lenses are made of millions of minute particles of an element unknown to science thus far which I have called *lumindust*. Now look through it again—and look with your heart in your eyes. . . ."

I bent down to the queer instrument, nervously conscious of Professor Frost's avid watchfulness. He hung over me, expectant. I sensed that his whole being was tense with the hope that I would see something that he wished me to see.

Aware of his anxiety, I concentrated with every atom of will n me. And suddenly the blankness before me began to disperse. Strange colors, the like of which I had never seen before, and which are indescribable because so far language has given them no names, began to float before me.

Professor Frost, eagerly noting my changes in expression, began to pull various levers by which the machine was adjusted.

"Tell me!" he cried. "Tell me what you see!"

"Nothing yet," I said breathlessly. "Just blobs of color—"

Then the colors began to change and out of the blur there came a picture vivid as life. *George Washington, quill in hand, signing the Declaration of Independence!*"

In a moment it was gone.

I looked up. Amazed and a little terrified I told Professor Frost what I had seen.

He listened, his face glowing, excited. Then he began to weep, softly.

Saturday

THAT was the beginning of months of study and effort which have no parallel in the annals of science. I must now swiftly put on record all that happened, for my hours are numbered. Tonight at twelve I die. I know it. I have seen it. . . .

Professor Frost's machine for capturing images of long-past events became my chief interest in life. I ate and slept only enough to maintain the barest vestige of life. Day after day, when conditions were right, I aided Professor Frost in his work, and spent long hours gazing through his light-wave machine.

Aston shing revelations opened before me. There is many a scandalous tale I can tell, many a popular fallacy about history I can explode. But you would not believe me.

Caesar's wife may be above reproach, but I have seen her in situations that—well, no matter.

I have seen Roman orgies and Greek festivals, and sinful ceremonies of the pagans. Would you like to know the true character of Nero? What page of history is tormenting you? The way to knowledge of the truth is open, but few would take the path.

Events that had happened in my own lifetime were there, too. Many things about our present world situation became increasingly clear to me. I saw how international disasters could have been avoided by merely making slight changes in the chain of events. A casual word unsaid; a casual deed undone; an impulsive gesture checked—and this world would be a different place, a better place today.

I gasped with fright as I saw the assassin at Serajevo raising his gun to

kill the Archduke of Austria! I screamed:

"Stop! Don't shoot!"

I was quaking from head to foot, my pulses pounded in my brain! Quickly I adjusted levers that made it possible for me to retain that image.

Long hours I sat gazing at it, wondering, speculating. . . .

In my mind's eye I envisioned the whole vicious train of events that we call the World War. I saw men marching, confident, assured. I saw the hell of trenches, the piled-up dead, the armless and blind and legless.

I saw a crimson blot spread over the whole of the earth, a blot that must be erased if civilization is to survive!

And it occurred to me that if I could go out in space and reach the assassin, I could stay his hand. . . . I could change other events, I could obliterate the World War from history.

This is the part of my story that they absolutely refuse to believe. Yet isn't it clear—we are ourselves no more real than those waves of light. If they are shadows, we too are shadows. I prefer to believe that we are material and substantial beings, and that they too have substance . . . and live. . . .

Feverishly I began to study ways and means of achieving my objective. I cursed because the development of rocketry has been so terribly, terribly slow. Perhaps, in a rocket. . . .

I kept the machine adjusted for days so that I could study the grim scene before me, the scene so fraught with menace for the future.

I knew I would have to be faster than light to overtake this page of history!

And then the solution dawned on me! Only one thing in nature is faster than light. And that one thing is human thought! I would reach Serajevo with my brain!

And so I sat before that queer, uncanny machine for days on end, totally disregarding food or sleep; sat there, muscles tense, concentrating on that one thought:

"Drop that gun! Don't shoot!"

And at length my command was answered. I saw the assassin drop his gun and flee!

A sigh of relief escaped me. And then I fell in a heap, unconscious.

Later

I AM exhausted but must tell the remainder of my story in the little time that is left me.

When I came to, I was surrounded by a doctor, a policeman and Professor Frost. As soon as I regained some composure, I told them what I had seen and done. To my amazement they laughed. Then they seemed gravely concerned over something; they spoke in whispers. . . .

The fools sent me to an asylum, and not even Professor Frost lifted a finger to help me! Oh, those long hours when I sat in my cell, or paced up and down, and thought of the good I could be doing humanity! Oh, the hate I felt for my captors, those misunderstanding idiots! They called me a dreamer with delusions—me!

I was finally released from the asylum. I was allowed to visit the mysterious instrument which they said I had "raved" about. Several officials were with me.

That was yesterday. Then it was that through the medium of the light-wave machine I visited myself in my younger days. Then it was that I looked into the future for the first time and saw my own death . . . the Death which is to take place in a few hours from now. I will die of a sudden stroke—I have seen it happen already!

But Professor Frost was not there with me, for he had already passed on, his heart broken. He, too, had suffered because of his superior knowledge which people could not understand. After I was sent to the asylum he was derided as a mountebank by the press, the public. His machine was described as a clumsy apparatus without even the powers of a telescope—the invention of a crackpot scientist! It became a standing joke among newspaper comic artists and columnists.

And when I told the asylum officials that I again had glimpsed the past—carefully keeping to myself the fact that I am to die tonight—for I could not speak of that to these brutes—they shook their heads, exchanged solemn,

sorrowful glances. The fools!

And when I invited them to look into he machine, themselves, they looked —and saw nothing. So they brought me back to this cell.

But it does not matter. Nothing matters now, save that someday another may carry on where I left off.

I am leaving this world with a glorious vision—a dream of the beauty of the perfect life when men will be able to change events to avert calamity and disaster.

But my heart is heavy within me when I hink of what *I* might have done. Checking the assassin at Serajevo was not enough. I could have saved the *Lusitania;* I could have curbed the activities of money-mad war profiteers.

I could have destroyed every munitions factory in the world!

I am tortured by the thought of all the needless suffering, the carnage of war. The crimson blot on the history of mankind that does not let me res . . . .*

*NOTE: Here this diary abruptly ends. It was found clutched in the lifeless fingers of Alvin Wright, patient at the State Asylum, the morning after the last entry. Doctors established the time of Mr. Wright's death as about midnight.

WHAT IS YOUR SCIENCE KNOWLEDGE?

Test Yourself by This Questionnaire

1. Name the four largest moons of Jupiter.
2. What was Galileo's famous experiment?
3. Where is the Mare Imbrium?
4. According to Spengler, what was the conception of time, as visualized by the Ancient Greeks?
5. What is the diameter of Sirius, in relation to the Sun?
6. What are the properties of the star, Mira Ceti?
7. How long approximately is a Martian year?

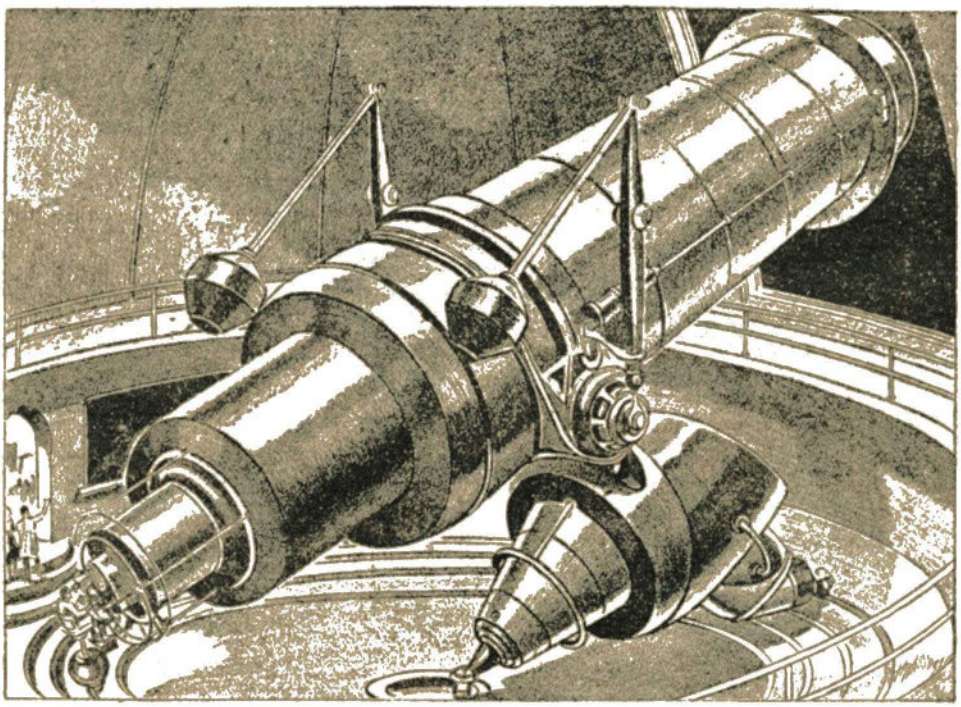
(A Guide to the Answers Will Be Found on Page 129)

A New Article by

GIANT AND DWARF STARS

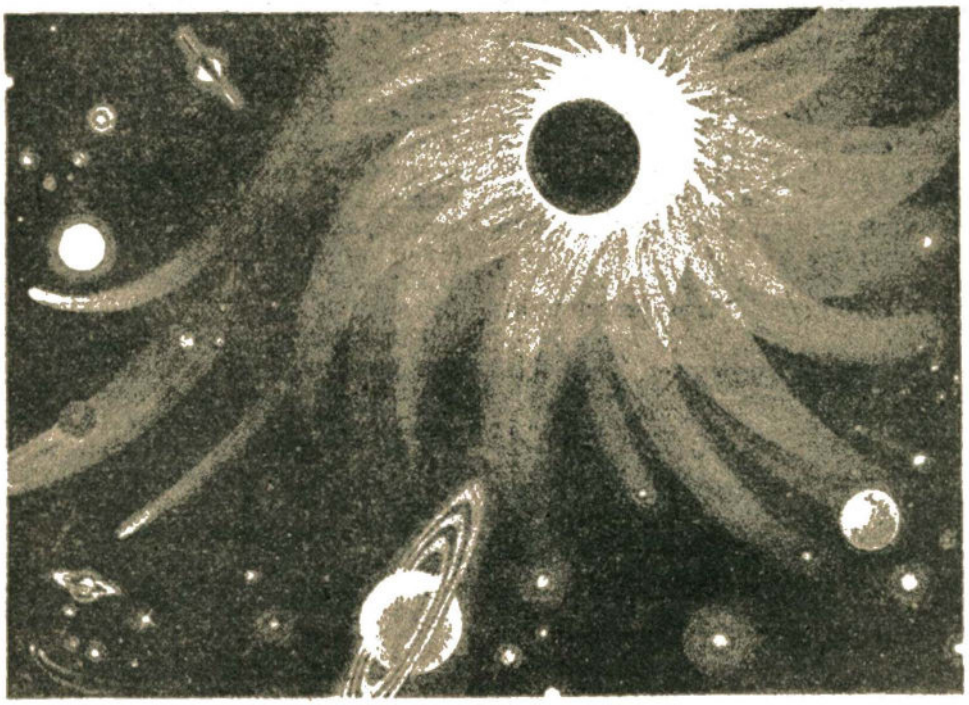
IF we look low down in the southern sky in mid-winter, or still lower on a spring evening, we see the well known belt of Orion—three bright stars lying evenly spaced in a straight line. Trailing behind this line of stars at about eight times its length behind it, we see a specially bright star. This is Sirius, which is not only the brightest star in the whole sky, but is conspicuously the brightest, being five times brighter than any other star we are able to see in these northern latitudes.

Not many years ago, a telescope-maker was testing a newly made lens by looking at Sirius, and was surprised to discover, close to it, a much fainter



Visit Your Cosmic Neighbors with

SIR JAMES JEANS



star which had not been noticed before. This is now known as the Companion to Sirius, because years of observation have shown that it is a true companion —not a mere passing acquaintance which is close at hand today, but will be lost in the depths of space in a few million years' time. The two stars are really traveling through space together, the one describing an orbit round the other much as the moon does round the earth or the earth round the sun.

The new companion looks much fainter than the old original Sirius, and as the two stars must be at approximately the same distance from us, this can only mean that it must be this much fainter in itself. Exact measurement shows that it gives out only about a ten-thousandth part as much light as Sirius itself.

QUANTITY AND QUALITY

YET, in spite of this immense difference in quantity, the quality of the light of the two stars is much the same. The great difference in brightness of the two stars must then be the result of a great difference in size. Sirius looks brighter than its companion simply because it has a larger shining surface. Precise calculations show that Sirius has nearly twice the diameter of the sun, while its small companion has barely a thirtieth of the diameter of the sun. This is only three times the diameter of the earth, so that of these two stars which are traveling through space side by ide, one is a full-sized star, while the other is only a planet in size.

So great a difference in size seemed

very sensational when it was first discovered, so much so that some astronomers were inclined to dismiss it as incredible, but we have become accustomed to it now. Indeed, astronomers have recently found stars which are even smaller than the Companion to Sirius—some smaller even than our tiny Earth. One of these minute stars, discovered by G. T. Kuiper only two years ago, is believed to have only about half the diameter of the earth, although we cannot be very sure as to the exact figure.

At the other end of the scale, we know of stars which are enormously

A sphere of steel would flatten under its own weight

larger than Sirius or our sun. The largest so far known are Antares and Alpha Herculis, both of which have about four hundred times the dimensions of the sun; if our sun were suddenly to swell out to the size of either of these stars, we should find ourselves well inside it; indeed both stars are larger than the orbit of Mars.

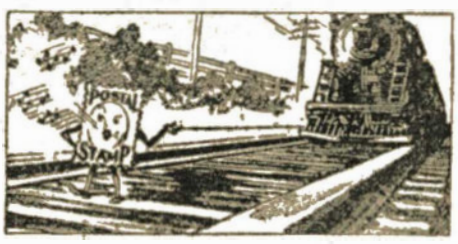
These immense stars are approximately known as "giants," and are just ordinary stars in every respect except size; there is a gradual transition between them and stars like our sun. But it is different with the very small stars; as regards their properties and qualities, these form a tribe by themselves, with no gradual transition between them and the more ordinary stars. In brief we may say that there are sun-sized stars and planet-sized stars and nothing in between. But the planet-sized stars do not segregate themselves in any one part of space; they are thoroughly mixed up with all the other stars. The majority of those so far known are like the Companion to Sirius in forming permanent companions to larger stars.

The star Procyon is a typical case; this consists of two constituents, one being a fairly close copy of our sun, while the other is probably smaller than our Earth, and possibly no larger than Mars. We may compare the planet-sized companions to the tiny pilot fish which swim about in a permanent friendship with certain kinds of whales and sharks, and, appropriately enough, a sensational example is to be found in the constellation of the whale, in the well known variable star Mira Ceti.

This consists of two stars in permanent companionship; the larger, which we are comparing to the whale, has about a hundred and fifty times the diameter of the sun, while the smaller is only about the size of Saturn. In this case the sizes are so different that it hardly seems right to compare the smaller star even to a pilot fish; if the larger star is a whale, the smaller is rather less than a quarter of a shrimp.

ENORMOUS RANGE OF TEMPERATURE

THESE planet-sized stars are known as "white dwarfs"—dwarf because of their small size, and white for a reason which I must now explain. When we view the stars as a whole, we find that their surfaces show an enor-



A postage stamp could run a train

mous range of temperature. The coolest are not much hotter than a really hot coal fire—their surfaces are only at a red heat, so that we may describe them as "red" stars. The surfaces of more ordinary stars like our sun or Sirius are about four times as hot;

these may be described as yellow or white stars because they are at a yellow or white heat.

Hotter still are the surfaces of certain other stars which are known as blue stars; most of the light they send out lies at the blue end of the spectrum, although this is only a small fraction of their whole radiation, which consists mainly of ultra-violet rays which we cannot see at all with our eyes. These stars are immensely hot, their temperatures being anything from three to ten times that of the sun.

Now those white dwarfs which were discovered first, all had surfaces at what we have described as a "white" heat—somewhat hotter than our sun—hence the name "white dwarf" which has got attached to the whole class. But we now know of many examples at a blue heat—that is to say at many times the temperature of our sun.

On the other hand no red examples are known at present. Many may exist, but may have remained undiscovered because of their extreme faintness. For a red star shines with only about a thousandth part of the brilliance of a white star of the same size, and with less than a ten-thousandth part of the brilliance of an equal-size blue star. This being so, it is natural that the blue and white stars should make us aware of their existence, while the more modest red stars, if any exist, should continue to blush unseen.

If we compare ordinary stars to coal-fires in hearths or braziers, we must compare the known white dwarfs to very minute electric light bulbs—the kind we use in pocket flashes—or perhaps even better to the incandescent carbons of electric arc lights. They have small surfaces but the amount of

The Queen Mary would draw less than an inch

light and energy coming from each square inch is immense—and this it is that leads to their detection. But the red stars of this class, if any exist, can only be compared to glow-worms or fire-flies.

[Turn Page]

THE SUPER-ENERGY LOCKED IN THE STARS

THE fire in the fire-box of a locomotive, with a surface of perhaps forty square feet, gives out enough energy to run a train. The coolest of known stars give out perhaps four times as much energy per square foot, so that we could run a train from the energy given out by about ten square feet of their surface. The sun, at more than four times this temperature, gives out about fifty horse power to the square inch, so that a bit of the sun's surface of the size of a postcard gives out enough energy to run a train.

Now all the white dwarfs so far discovered give out substantially more energy than this—in most of them we could run a train from a bit of surface of the size of a postage stamp, while on the hottest of all the output of energy is almost unthinkable—a bit of surface of the size of a postage stamp could run the *Queen Mary* or the *Normandie*, or perhaps both.

Stars of this last kind are exceptional in many ways. They are the hottest stars in the whole sky. And in a certain sense they are also the largest. I just said that the white dwarfs are the smallest of stars, and so they are, but these particular white dwarfs are surrounded by atmospheres of immense height, which are lighted up by the radiation from the star itself—and when we look at them through a telescope we see them as vast balls of glowing gas, each having a vividly bright star at its center.

These are the objects that used to be described as "planetary nebulae," although we know now that they are just stars. If we disregard their atmosphere they are among the smallest stars in the sky, but if we take their atmospheres into account they become the largest, their average diameter being about six hundred times that of the orbit of Pluto.

The more ordinary white dwarf star is a mere planet in size, and yet, inside its dwarf planet-sized body, each contains as much matter as an ordinary star. The Companion to Sirius probably contains rather less substance than our sun, but the star recently discovered by Kuiper is believed to contain about three times as much. It is as though we had caught a shrimp and weighed it, and found that it weighed as much as a whale.

A MILLION TONS TO A CUBIC FOOT

LET us think what this means. Kuiper's star contains about a million times as much substance as the earth, all packed into a sphere which has only half the diameter of the earth. This being so, the average cubic foot of its substance must weigh more than a million tons; it would need twenty-four thousand tons to fill a pint pot.

In an ocean of such matter all terrestrial objects would float like soap bubbles floating in an ocean of mercury; if we placed the *Queen Mary* in such an ocean, she would draw only about a one hundred-thousandth of an inch. We could run trains over such an ocean, and they would sink to nothing like the depth of the flanges on their wheels.

Yet we must not try the experiment on the star itself, for if we do, our ships or trains will collapse under their own weight. On Kuiper's star gravity has four million times the power it has on Earth. A sphere of steel, whether large or small, whether a cannon-ball or a ball-bearing, will flow and flatten out under its own weight on this star, just as a drop of quicksilver does on Earth. In the interior of the star even the atoms must have collapsed under the intense pressure; this is why they can be packed so closely together, and occupy so little space.

The properties of matter in this state can be studied theoretically, and prove to be of great interest. If we increase the pressure, we naturally increase the degree of collapse of the atoms, and this effect may be so marked that piling more matter on to the surface of a star may make the star actually decrease in size. So that very massive stars may be smaller than less massive stars.

Actually there is a certain critical size which no white dwarf can ever exceed when it is cold, although its heat

may induce a kind of expansion and so increase its size beyond this limit. This critical size is roughly that of Jupiter; and the star reaches this critical size when it has just about the weight of Jupiter.

This has led to the suggestion that Jupiter itself may consist of matter in this state of atomic collapse. Not only so, but it is possible to calculate what the sizes would be of other chunks of substance in this state. Two Indian investigators, Kothari and Majendar, of the University of Delhi, have calculated what would be the sizes of bodies containing as much substance by weight as Saturn, Venus, Earth and Mars, and find sizes which agree fairly closely with the actual sizes of these planets.

They conjecture that the interiors of the planets may consist of matter in this state. It is an interesting conjecture.

If further research confirms it, then the nearest "white dwarf" will prove to be very near home indeed—it will be our own earth.

SCIENTIFACTS

(Continued from Page 57)

the original cell. Then the two split apart and two new yeast cells are formed. Yeast reproduces in this manner at a phenomenal rate. For instance, under favorable conditions a teaspoonful of yeast will have sufficient progeny within a week to produce twenty-five million loaves of bread and every loaf of bread will contain more yeast cells than there are people on the face of the earth.

THE MILLION DOLLAR METAL

METAL can be manufactured which is six-millionths of an inch thick! Engineers at the Schenectady, N. Y., branch of the General Electric Company recently welded together strips of two alloys, Copnic and Chromel, and then rolled them to a thickness of six-millionths of an inch.

The material formed by this junction has a very small heat capacity and will respond rapidly to a change in temperature. Engineers estimate that a pound of this product would cost several million dollars. Gold has been beaten to four-millionths of an inch thickness, and aluminum has been thinned by the same treatment to ten-millionths of an inch. But this is the first time two alloys have been reduced to such a thin section by rolling. The feat was achieved by placing the welded strips of alloy between pieces of steel and rolling the complete assembly. The product is not yet manufactured for general sale.

TRY THIS SCIENTRICK!

YOU can make a ballon follow you! This is a very simple trick, but one that does not seem to be generally known. Stroke an inflated rubber balloon with a silk handkerchief. A charge is thus transferred to the surface of the balloon. As the charges on the balloon are attracted by neutral bodies, the balloon will readily approach your hand extended toward it and will even follow you around the room until the charge is lost to the air.

LIFE ETERNAL

Anton York, Nomad of the Cosmos, Pits the Wisdom of Ten Centuries Against the Immortal Renegade Who Can Move a World

By EANDO BINDER

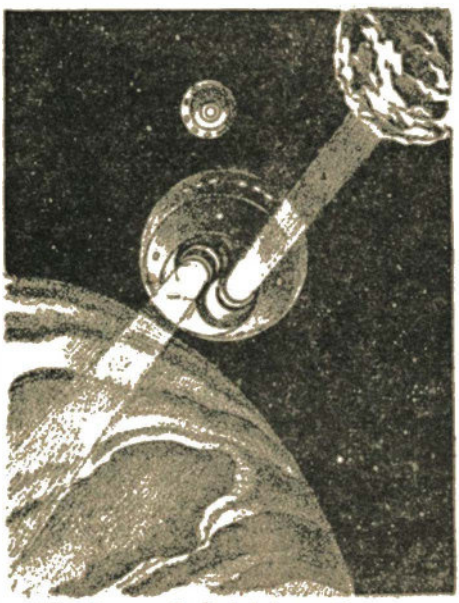
Author of "Conquest of Life," "The Chessboard of Mars," etc.

CHAPTER I

An Immortal Plans

MASON CHARD laughed.

For a year now he had been cruising aimlessly in the interplanetary depths of the Solar System. His beryllium-hulled space ship was motivated by the controlled



The Immortal's lethal beam shot out

interplay of the gravitational stresses filling the void. His power plant greedily absorbed solar radiation and rammed it through whirling quartz coils which cut the force-lines of gravitation, producing reactive motion. The same titanic energies which swung the ponderous planets in their eternal orbits were used, in part, to propel the tiny ship. It was super-power, limitless. And eternal, in the sense that gravitation was eternal.

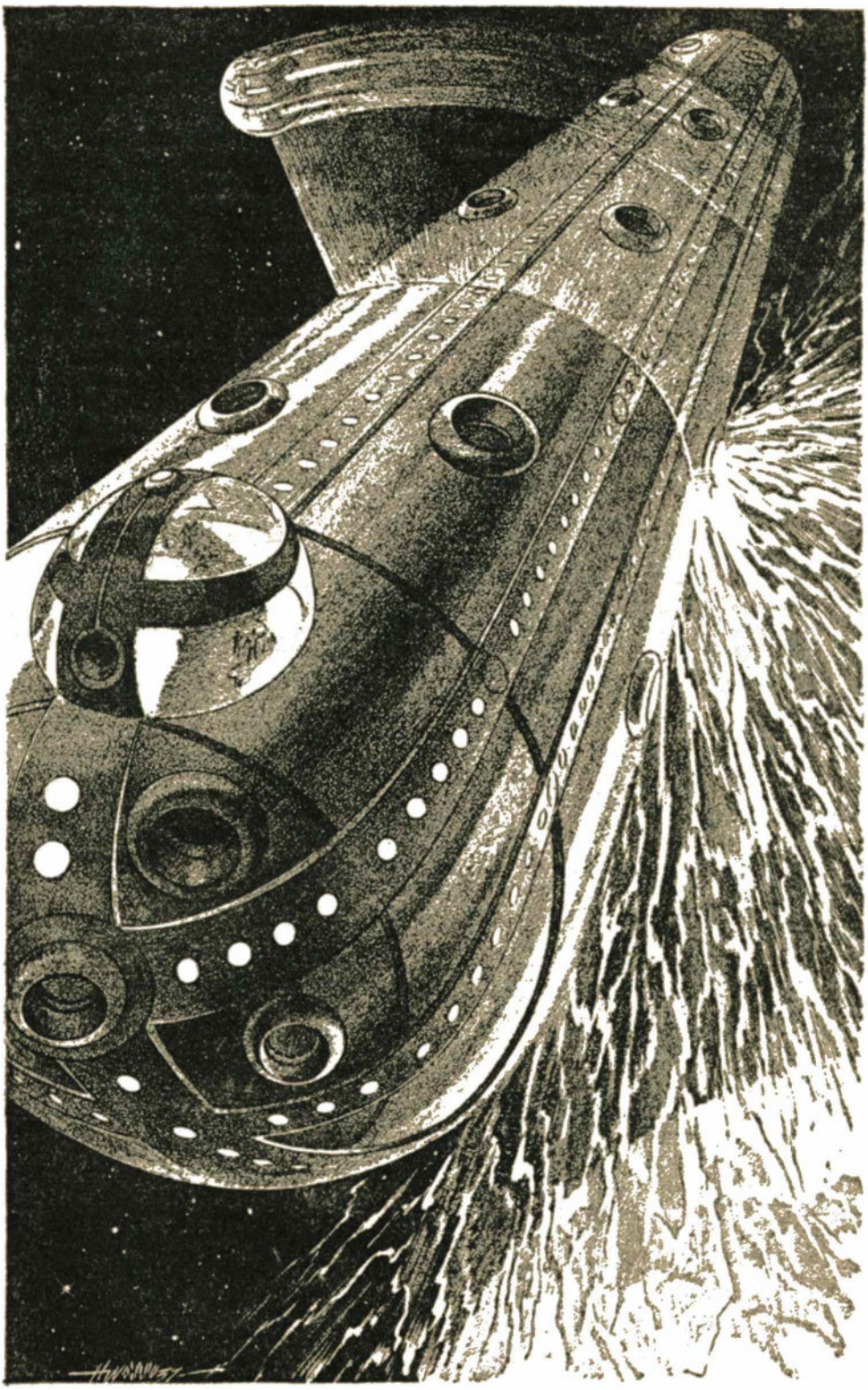
Eternal!

Mason Chard liked that word. For, barring violent death, Mason Chard himself was eternal! In his veins flowed blood enriched with a self-renewing enzyme that was the antithesis of death and decay. His body cells were doubly endowed with radiogens, the tiny batteries of life which sucked energy from the cosmic rays, from the universe at large.

Mason Chard could not die from "disease" or "age" until the Universe had run down to the point where cosmic radiation was halved. That would be millions of years in the future!

The Immortal laughed again. His ruminations covered, in reverse order, the most eventful thousand years in human history. Just the year before, Earth's vigorous race had established an outpost on far Pluto, thus completing a phase in its empire building. Previous to that there had been interplanetary wars, heroic pioneering, and dauntless feats of exploration. The parade of a thousand years, glorious and packed with drama, marched through Mason Chard's mind. The

A Novelette of Solar Secrets



A shimmering violet beam bit viciously into the hull

laughs that punctuated his ponderings were for those times he, Chard, had interfered with the course of history.

There was the time, for instance, he had led the insurrection of the native Callistans against the domineering Earthmen, purely for the diversion of espousing a lost cause. At another time it had been his whim to destroy three successive rescue ships on their way to a marooned group of explorers in the wilds of Titan, so that he could watch brave men die.

Chard had had to amuse himself in those endless centuries to escape the dreary cycles of ennui. He had long felt elf above the ties of race and allegiance. Roaming the interplanetary void at will, a mysterious and half-mythical anarchist, he had often dammed the progress of mankind's growing dominion in the Solar System. Along with the ties of blood and tradition, Chard had thrown conscience into the discard. It had not caused him one twinge to see thousands of space ship crews annihilated in the intra-world war he had personally embroiled, five centuries before, between Venus and Earth. He had watched the holocaust through his vision screen, grimly amused.

Mason Chard had never taken the trouble to analyze himself. If he had, he would have realized himself to be a colossal ego, inflated by the drug of immortality. He would have recoiled from the picture of a cold, heartless, scheming scoundrel, clothed in a super-vanity. Yet perhaps only one little thing made him this, rather than an honored, inspired, immortal leader—

His chuckle was just a bit bitter as reminiscences took him back to that time almost a thousand years ago when he had run afoul of Earth law. Realizing his immortality, he had started an abortive drive for world domination. He had not planned thoroughly and had been captured. Fortunate that capital punishment, even for treason, was outlawed in that day, he had been exiled to a lonely asteroid. His sentence had been 199 years. There, for seventy-five years, he was made to attend the warning light beacon that warded off space liners. A supply ship had come once a year.

The only light spots in that dreary, bitter incarceration were those times the officials had been amazed at his longevity, not knowing he was immortal. He had been a man in the prime of life at the start of his sentence. He was still a man in the prime of life seventy-five years later. He might have waited to serve out his 199 year sentence, to confound them utterly, but before that a pirate of space landed to destroy the beacon in some deep-laid plot. Chard gratefully joined the pirate crew, became their leader in a few years, and later betrayed them.

Thus had his career begun. Then Chard's reflections went back to the stirring events of the middle Twentieth Century. He had been thirty-five then—really thirty-five—occupied as a research scientist. Dr. Charles Vinson, his former instructor, had called him to a secret conference with a half hundred others, unfolding a breath-taking scheme. He had inoculated them all with the Elixir of Youth, whose formula he had stolen from Anton York, and as immortals they had begun the subjugation of Earth. Anton York himself had defeated the plan, destroying the Immortal fleet.

Of the Immortals, only Mason Chard was left. He had been left in charge of their secret underground headquarters in Tibet and had thus escaped York's vengeance. For years he had remained in hiding, waiting until Anton York had left the Solar System, plunging out amid the stars like a god whose duties were done. Chard, keeping his identity secret, had watched Earth, equipped with the legacy of space travel York had left, attempt the conquest of the Solar System.

And then had come his lone and foolish attempt to win the rule of Earth. Reaching again this point in his review of the past, Chard laughed once more, this time harshly.

"A thousand years I've fooled around and played with fate," he muttered to himself, staring out at the dome of stars. "But I have learned

much. I am prepared now to accomplish the aim that Vinson tried and failed, and I later, and before us, men like Napoleon, Attila the Hun, and Alexander the Great. I am going to conquer the world. Not the world they knew, but the world of today—the entire Solar System!"

His cold, cruel eyes blazed with sudden fire.

"I have the power to do it. And more important, I know the method. It must be done through fear! Fear is the common weakness of all humanity, excepting myself. I have learned to laugh at fear. But these mortals, they know fear. It can strike them powerless, tie their hands and wits. I will conjure up a fear that will strike in every heart in the Solar System. I will play up this fear, feed it, until they grovel at my feet. I will become emperor of nine worlds!"

In the melodramatic ecstasy of the moment, Mason Chard flung a clenched fist toward the watching stars, pledging himself.

"One against six billions—and I will win!" he boasted. Once again his super-ego had found something on which to feed itself.

CHAPTER II

Nomads of the Cosmos

SOMEWHERE, far out in interstellar space, Anton York, a man-made god, roamed the uncharted deeps of the void. Immortal and wise beyond human understanding, he plunged on in a timeless lethargy, taking pleasure in observing the slow majesty of the cosmos. The stars surrounded him like silver studs in the celestial vault. With him was his immortal mate, Vera York.

Their earth-born love had transformed itself into a spiritual bond that made them almost one. They did not need food or air; their bodies were in a state of suspended animation. They lived only in the mind, exchanging thoughts by telepathy. Their ship drew illimitable power from the vast storehouse of energy with which space was crammed—the cosmic rays. Subtle warpings of the gravitational lines of giant, distant suns gave the ship lightning motion. Unbound by the blind rules of Earthly science, they had often, and at will, exceeded the speed of light. On and on they had gone, nomads of the cosmos.

At times they had slowed and visited other planetary systems, had held concourse with alien races. Life exhibited itself to them in a hundred strange, incredible ways. Minds existed in the Universe whose thought processes were unfathomably queer. Never had they felt any kinship with other intelligences. And never, in all their Brobdingnagian journeying, had they found any planet system quite like the Sun's, nor any world quite like Earth.

Suddenly they knew what it was. Immortal they might be, abhuman and superhuman, children of space itself, but they could not deny what it was—nostalgia! They had lived in space five times as long as on their birth-world, yet on the way back they knew they were heading—home! A warm pulse-beat rose in their brains as they neared the little yellow-white star buried near the hub of the gigantic pinwheel of the Milky Way Galaxy.

When the Sun had begun to enlarge among the stars, Anton York willed himself out of his hypnotic state of bodily suspension. Mind-controlled relays turned on the various mechanisms that supplied heat, air, and artificial gravity. His lungs took in a deep, shuddering breath, the first in several years. His heart suddenly began rumbling in his chest. Congealed blood, bearing the Elixir-enzyme, began to circulate to body cells whose radiogens drew life-energy from the cosmic rays.

His wife, Vera, joined him a moment later. They embraced, and drank the thrill of corporeal existence. Their ship was once again a living room, after being a cold, preserved coffin for the years of their swift journey through remotest space.

York consulted his instruments and made rapid mental calculations.

"We've been gone from the Solar System just one thousand and one years, Earth scale," he announced. "When we left here we were thirty-five years old, physically. And that's exactly how old we are on our return—physically. Of course mentally, spiritually, we're much, much older. We've *lived* some, haven't we, Vera?"

"Gloriously, Tony!"

"Odd that we've come back here, to this drab little planet system. Remember the grand system of the triple suns—one white, one orange, one red—with its fifty-six gigantic planets? And yet, in a way, I'm glad to be back here."

"There's no place like home," quoted Vera gaily. She knew she was going to enjoy the revival of old memories and associations.

YORK wheeled the ship in a course high above the plane of the Solar System, as they approached, adopting a wide-swinging parabolic course. Soon dark and gloomy Pluto appeared among the stars, grew to high magnitude, then faded in the rear. Pinkish Neptune with its one great moon paraded past their ports, like a will-o'-the-wisp. Steel-grey Uranus, with its smoky atmosphere, exhibited four huge satellites, considerably off to one side.

York cut obliquely and swept over xanthic Saturn with its brilliant Rings and brood of moons. Vera studied the sight with their ship telescope, remarking that for sheer beauty the Saturnian system was unmatched in all space.

Cyclopean Jupiter hove to, an agate striped with brownish bands, the largest of planets with the largest number of satellites. They had seen monster planets beside which Jupiter would be a pea, but somehow, for sheer impressiveness, this great planet was second to none. Vera, gazing at it through the telescope, expressed her admiration. The four largest moons glinted brightly not far out from their primary. The smaller satellites were fainter, but distinguishable from the pinpoint stars by their small discs.

Suddenly Vera looked up.

"Tony," she asked puzzledly, "how many moons did Jupiter have?"

"Ten—and still should have."

"That's what I thought." Vera bent her eyes to the binocular sights again. "Strange," she declared after a moment, "only nine moons are there now!"

"What? That's nonsense!"

"Look for yourself."

York looked, and counted. He saw the first small Jovian moon, close to the planet like a tiny silver flea preparing to land. Further out, in order, were the four largest moons, Io, Europa, Ganymede and Callisto. Seven times as far was another small moon. Twice as far out as this were two still smaller satellites. And a little further out, the last. Their total was nine. Obviously, one was missing. But which one was it?

Not trusting to memory—memory that would have had to reach back a thousand years—York rummaged through his chart closet and retrieved an old astronomical book. He turned to a diagrammatic picture of the Jovian system and compared the printed orbits to imaginary ones in the telescopic view. The missing moon was number six, a small one of perhaps a hundred miles diameter, whose orbit had been more than seven million miles from Jupiter's surface.

"Some mystery here," York muttered, straightening up. "A moon just can't go disappearing like that. We've been away a thousand years, yes, but that moon revolved in its orbital groove for millions of years before that!"

What did the missing moon of Jupiter signify? A clue revealed itself several hours later, as the Jovian planet drew steadily nearer. York had turned on his powerful radio receiver and listened to the amazingly clipped speech that vibrated through the ether. Evidently the English language, though universally used, had suffered considerable alteration. Listening carefully, York realized it had been brightened and made more flowing. Undoubtedly their speech would sound archaic to these people of the 31st Century.

Suddenly a powerful, booming voice had blanketed other stations and vibrated throbbingly from the loudspeaker. Its production must have cost a fortune in power. It was a cold, hard, emotionless voice, with arrogant inflections.

"People of the Solar System!" it said. "And particularly, Councillors of Jove! You are aware, undoubtedly, that the number six satellite of Jupiter has vanished from its age-long orbit about its primary. Where is it, you ask. It is at present a good many millions of miles from its former position and is still moving away. This phenomenon is unprecedented. You wonder what inconceivable, but natural, force has done this."

THE speaker paused and then went on dramatically: "It is *not* a natural force! It is man-made! Your lost Moon has been dragged away from its primary—literally—by means of a force-beam and a supremely powerful engine. I, the Immortal, built this super-engine and moved a world! My price for the return of this satellite will be complete rule of the Solar System!"

The voice became ominous: "I have demonstrated that I have in my hands illimitable power. If I can move worlds, I can destroy worlds! My demands are not unreasonable, for I have the wisdom of ages, far more than any other living man. I have lived more than a thousand years. I am immortal, and all-powerful. You will have twenty-four hours in which to discuss this matter, and arrange to call a council at which I will be made emperor. The Immortal waits."

"Did you hear that—*the Immortal!*" gasped Vera. "Is it possible that he is one of Vinson's group? Or has the Elixir been rediscovered?"

"It's one or the other," mused York. "The removal of a satellite from its orbit is no bluff. It's quite a feat, even though it is a comparatively small body. Whoever that person is, he's dangerous."

He stroked his brow thoughtfully.

"Vera, I had planned to go directly to Earth, to spend a few quiet years there. Incognito, of course. And then to stock up on supplies. But instead I think we'll hover around Jupiter and see the outcome of these amazing circumstances." His eyes narrowed. "Unless the human race has changed a lot since our time, there's going to be resistance to the Immortal's challenge for supremacy. And after that—trouble!"

Promptly when the twenty-four hours were up—Earth-scale being standard in the System—the Immortal's booming radio voice came again from the depths of space, demanding to know if his ultimatum had been accepted. York listened carefully for the reply, which came after a certain time lapse because of the distances involved.

"The Council of Jove, representing the Supreme Council of Earth and the Solar System, declines to accept your terms.

"You, the Immortal, are hereby declared an outlaw and a traitor. As such, you will be hunted and destroyed by our Space Patrol. If you will restore the sixth satellite of Jupiter to its rightful position, and give your person into custody, the ultimate sentence will be lightened."

FOR answer, a grating laugh came from the Immortal.

"I have been declared an outlaw by several other provisional governments in the past thousand years, but I have never been apprehended." The voice suddenly spat fire: "You will take the consequences of your answer. The missing satellite is thirty millions of miles from Jupiter. It will be returned to you—as a projectile! At the speed of a thousand miles a second, it will crash into Ganymede and destroy it! That is my answer!"

York snapped off the radio and turned to Vera with horrified eyes.

"He's a madman!" exclaimed Vera. "Tony, can't we do something about this? After all, these are our people; this is the world of our birth. We can't stand by and see an inhabited world destroyed!"

York sprang to his feet.

"We will do something!"

CHAPTER III

The Lost Moon

YORK bent over an instrument whose readings indicated that the Immortal's message had come from the direction of the Sun. Then he stepped to the telescope and scoured the region thirty million miles Sunward from Jupiter. He discovered it among the numberless stars, in the belt of Orion near giant blue Betelgeuse—a small half-disc. It was the lost moon.

York then seated himself at the pilot board and touched studs that guided huge gravitational stresses through his engine. Following a course he had already calculated in his mind, he drove his ship in smooth acceleration toward the tiny, lost moon. Like a ball from some cosmic musket, the ship hurtled Sunward.

Inside, nothing was felt of the tremendous, crushing acceleration York had applied. He had long before solved the secret of inertia-suspension. They could have leaped from a cruise to the speed of light in one second without the slightest discomfort.

An hour later their destination loomed large in their front port. It had moved position—toward Jupiter. The Immortal had already begun its furious thrust, aimed it like a Titanic cannonball for Ganymede. He had said he was doing it by means of a force-beam—a closed beam of artificial force which could be made more rigid and gripping than a solid bar of steel. York had used small force-beams himself, at times, to anchor his ship above strange worlds whose surfaces were not attractive for landing.

But this Immortal's force-beam was one designed to move a world. Only one force was capable of moving a world—another world's gravity field. He was either pulling it, or pushing it, by means of some great gravity field. If pulling, he was using Jupiter's gravity field. If pushing, he was drawing power from the distant Sun's field. Figuring rapidly, York decided he was probably doing the former, since Jupiter was so much nearer and more effective.

He slowed his ship's mad pace and took up an orbital path around its Jupiter side. If the Immortal was on this side at all, he must be at one certain spot—the spot bisected by an imaginary line drawn from the center of the moon to the position in Jupiter's orbit where Jupiter would be in twelve hours, and where Ganymede would be an hour later.

His quarry's distance from the moon's surface was one factor York could not foretell. It depended purely on the design of the force-beam projector he used. Thus, although York had the search narrowed down geographically, he had to hunt hit-or-miss in the third dimension spaceward from the lost moon's surface.

York wasted four precious hours searching for the invisible, silent, undetectable space-tractor with which the Immortal was catapulting the lost moon homeward. He spent only an hour on the Sunward side, where the sunlight would have quickly revealed any lurking ship. All this while the derelict moon's speed increased and it had already negotiated half the distance to Jupiter. In another five hours—

"The proverbial needle in the haystack," York muttered to his wife. His face was strained. Suddenly he snapped his fingers. "We'll have to take a chance," he said grimly.

The chance of being crushed by the terrific force-beam itself, designed to handle millions of tons of mass with toylike ease. York simply shuttled his ship back and forth over the general area under which the force-beam must be anchored. He rode ten miles over the surface, to give himself leeway. His weaving course would eventually run him into the path of the force-beam.

IT came finally—a furious wrench that made the entire ship groan and creak. It spun violently and dashed groundward at lightning speed, caught in the world-moving force of the beam. Securely strapped in their

seats, York and Vera felt as though they were being torn apart. Their inertia-suspension was not equipped to neutralize rotary motion. Vera fainted. York, with an effort of will, clawed at the controls and stopped their twisting plunge a hundred feet above the brittle, rocky surface of the lost moon.

Vera came to almost immediately, smiling gamely. York was exultant.

"Now we have him located!" he cried.

He adopted a course perpendicular to the spot they had nearly crashed upon, crawled up into the starry vault. Twenty-five miles above the surface the Immortal's ship appeared among the stars. It was a gigantic thing with two enormous, bulging tubes at its back. From one of these was projected the force-beam. It returned to the other tube after passing into the center of the planet below and firmly gripping it.

The motion of this moon-and-ship system was accomplished by creating an unbalanced strain of its appreciable gravitational field in relation to mighty Jupiter. As a stretched rubber-band tends to snap together, so the distended force-field strained to close the gap between.

With lights out in his cabin, York pulled close to the dark ship. Into his meteor-screen he phased in another screen, one that was supersensitive to electromagnetic waves of high power. It would allow transmission of the low-power radio waves, but any radiation of high power would cause it to snap on instantaneously an impenetrable blanket screen. This protective wizardry had many times saved York out in space among hostile races.

Idling next to the huge space-tug, York radioed across.

"Anton York calling the Immortal. I am just outside your side ports, a hundred feet away. Reduce speed immediately and reverse your force-beam."

Evidently the Immortal had had his radio set open and heard, for his laugh sounded.

"The Space Patrol, eh?" his voice hissed. "Take that—"

There was a sharp click in York's cabin, which cut off the radio voice abruptly. An eye-searing shower of sparkles blossomed where the Immortal's lethal beam of exploding neutrons had impinged on the protective screen. Again the sparkles cast a lurid glare over the two ships, and revealed an amazed face at one of the larger ship's ports. A third time the high-powered beam expended itself against the impenetrable screen of York's ship.

York broadcast as the trigger-touch relay screen released the stronger one.

"You can't destroy me. My screen is beam-proof. But I can destroy you, Immortal!"

A gasp came from the radio.

"What did you say your name was?" asked the Immortal, as though suddenly realizing he had heard the strange name before.

"Anton York."

"Anton York! Not the—"

"Yes, the same Anton York who left the Solar System a thousand years ago. The York who annihilated the armada of the Immortals, of which you are apparently a survivor. Remember the weapon I had—the one which turned the Immortals' ships to black dust? I still have that weapon!"

"W-what do you want?" came the Immortal's cowed voice.

"I told you before. Reverse your force-beam and slow down the moon you are dragging. Then you will take up the course I plot, which will return this moon to its former orbit as the sixth satellite of Jupiter. One slightest infraction of my orders and I will turn you and your ship to — black dust!"

TEN hours later the lost moon of Jupiter was restored to its age-old berth in the Jovian system, none the worse for its strange journey. It had not been inhabited nor even exploited for minerals. When York was satisfied that it had been given the right orbital speed to continue revolving properly, he allowed the Immortal to disengage the force-beam.

"You are coming with me now," stated York. "You have been branded an outlaw and must be turned over to

the courts for sentence. Be thankful your crime hasn't been the destruction of Ganymede, as you originally intended."

But Mason Chard, recovering from his first awe and fear at the appearance of the legendary York, had been thinking—and scheming. When he released his force-beam from the planetoid, he coincidently shortened its focus. Then he made his ship wobble as though he were clumsy at the controls. At the proper moment, when York's ship was at his back, he jerked the levers and clamped his force-beam to it. Yelling in triumph, Mason Chard twisted his ship in circles, whirling York's like a stone at the end of a string. He released it suddenly.

It receded into the starry background and dwindled to nothingness. Chard hastily rammed full power into his engines, to make good his escape. He took a course directly away from York's ship, eager to put as much distance between as possible. That, he realized soon after, was a mistake.

When York was able to stop the flight of his ship and return to the spot where his prisoner had been, the other ship was long out of sight. It angered him that he had been tricked so easily. On the long chance that the other's psychology had been to dash the other way, York immediately gunned his ship in the same line, with furious acceleration. He turned his meteor-screen to full power, for its protection, and scanned the dark regions ahead. A mounting velocity that had never been matched in the Solar System before overhauled the fleeing ship in a few minutes. York smiled grimly as a black shape ahead occulted stars like an expanding balloon.

Realizing his stupidity at the last moment, Chard veered his ponderous ship into a parabola. But York's ship clung near him as though attached by a chain. When Chard, in desperation, tried again to focus the powerful force-beam on his pursuer, a hazy beam of violet stabbed from York's ship, sheering off the force-beam projector neatly. The fused beam of ultra-sound and gamma-radiation turned the metal it touched into black dust, as it had turned to black dust fifty Immortal ships more than a thousand years before.

Chard gaped at the instruments which told of destruction in the rear part of his ship and turned white. Hastily he snapped on his transmitter.

"Don't destroy me!" he pleaded. "I surrender, York!"

"Very well," said York grimly. "Let's report to the Jovian Council. Head for Ganymede. I'll follow."

Chard had no alternative. Bitterness charged his heart as he swung toward Jupiter, completely subdued. The blow to his puffed ego made tears of helpless anger well to his eyes.

If the Jovian Councillors on Ganymede had been amazed at the disappearance of their moon, they were still more astounded at its sudden reappearance. The fears of the panic-stricken inhabitants of Ganymede were quieted. Had this all been a huge practical joke by that queer, half-mythical person who had flitted in and out of history during the past thousand years? Or did it have a deeper significance. Many there were who did not believe in the existence of Mason Chard, explaining it as a recurrent fable dating from the time of the Immortals a thousand years before.

An attendant approached the Chief Councillor and whispered in his ear. The latter looked at the attendant as though he thought him insane, but at his earnest look nodded and sent him away. Then the Chief Councillor turned to his colleagues and raised a hand. His face was bewildered.

"Gentlemen," he said in a high-pitched voice, "we are to be honored with the presence of the Immortal, the man who recently threatened this world with destruction! And his captor is a certain—Anton York!"

A DEAD silence came over the room. Every face looked incredulous. Anton York, the greatest figure in past history—the immortal who had given mankind the secret of controlled gravitation. And then, more a god than a man, had plunged into outer space, no longer concerned with the petty affairs of men. *He* was here?

The silence became more impressive, if that were possible, as York strode into the room, followed by his dejected looking prisoner. York stood before them, a man of thirty-five years of age, tall, strong, virile. Physically he was no different from any other man in the prime of life, but he carried an aura of superintellect that was immed ately noticeable. The Counc l-lors felt themselves shrinking mentally.

"You say you are Anton York," stammered the Chief Councillor, trying to be officious. "But what proof have you—" He broke off, staring fascinatedly into York's wisdom-filled eyes. "You *are* Anton York!" he whispered, in stark realization that he could be no other with eyes like that.

York told his story, in what to them was queerly archaic English. At the end he gestured to Chard. "He is your prisoner," York concluded. "His sentence will be in your hands."

Mason Chard said nothing. He seemed utterly deflated in spir t. But his eyes glared at York with a world of hate toward this man from the past who had come back like a ghost to spoil his plans. York stared back dispassionately. They stood thus, eye to eye, for a long m nute. Two immortals from a long-ago era, meeting in a far future to find themselves opposed in aim and purpose. All the things of their time were dead and forgotten, except as history, but here they stood, a millennium later, to find themselves natural enemies.

The Chief Councillor tried to look sternly at the Immortal, but was awed by him, too. This man had eluded the forces of law and order in the Solar System for one thousand years. At last guards were called in, to conduct him to a prison for later trial.

"And now, sir," said the Chief Councillor, turning to York, "in behalf of the Supreme Council of Earth, the here-present Council of Jove, and the united peoples of the Solarian Empire, may I extend our deepest gratitude for—"

York waited patiently while the Chief Councillor, rising to the occasion, went on in this vein for several m nutes. When he stopped for breath, York acknowledged the speech with a few polite words and then asked a question.

"Has the secret of immortality been rediscovered?"

"No," replied the Councillor. "Mason Chard, the only Immortal alive today, was from the original group of the 20th Century."

Within himself, York sighed in relief. His father had been fortunate to stumble on one of the greatest secrets of the Universe, the secret of immortality. Pure, blind luck it had been, probably, against all the laws of chance. Better that the secret never again be discovered. It had caused sufficient trouble at one time. It had more possibilities of harm than good, as exemplified by Dr. Vinson's disastrous scheme, and now this Mason Chard's subversive career.

York stayed with the Jovian Council, an honored guest, to ask many more questions. He had heard the histories and doings of many queer peoples in interstellar space, but this one had the appeal of familiarity. He thrilled to the epic thousand years of mankind's advent in the Solar System.

THEN, to see this great glory of man's dominance in the nine-world empire, he and Vera embarked on a tour of the planets. But they did not leave Jupiter until they had witnessed the trial of Mason Chard. The criminal seemed to have suffered a change of heart after his encounter with York. He promised that in exchange for his life, forfeit under the law, he would work as a scientist for the betterment of mankind. By a narrow margin, his request was granted. A plan was drawn up for a laboratory to be built on the sixth satellite of Jupiter, the very one he had tried to destroy, in which he would labor, under heavy guard.

"They had better make the guard strong enough," was York's private comment to his wife in their ship. "Mason Chard is not the one to be trusted. The memory of a thousand years of absolute freedom is going to irk him considerably as his prison

years go by." He shrugged. "But that is their problem. You and I, Vera, will make a tour of the Solar System; see just what the posterity of our time has done. It will be something like viewing the handiwork of our children."

Their little globular ship was seen on every one of the worlds in the next year. The two immortals, everywhere looked upon with awe and wonder, were a little amazed themselves at the wideness of man's activity. Earth's sons were in evidence everywhere, in communities ranging from great spanned cities to little isolated outposts a million miles from nowhere, literally. No environment had proved too trying. No dangers too great. No difficulties too hazardous. No other race of beings equal or superior.

With little more than his bare nerve, man had gained a toe-hold on a variety of misfit worlds. It was the beginning of a truly colossal undertaking—the complete annexation of all the Solar System. On remote, frozen Pluto, a band of hardy scientists reconnoitered, for possible colonization, the wastes of that planet.

On the way back from Pluto to Earth, York became very thoughtful. "Vera," he said suddenly, "how do you suppose the colonists on Venus would like to have a moon in their skies?"

"What a crazy question!" said Vera, laughing. "Are you serious?"

"I was never more serious in my life," York objected. He went on musingly: "If Mason Chard did nothing else, he gave me a great idea. He moved a moon—a world! Man, in progressing, must either adapt to his environment, or change the environment to suit himself. Vera, Vera!" he cried. "Don't you see? Why not remake the Solar System to suit mankind?"

"But can they do it?" asked Vera, not quite grasping his meaning.

"They!" exclaimed York "No—*we!* We can do it!"

Six months later York had completed his plans, stupendous plans which he presented to the Supreme Council on Earth in a simplified form. "All I will need," he told them, "is the one ship built under my instructions, and full cooperation in certain state matters that will arise later."

The Supreme Council, the rulers of all the empire, were stunned by the magnitude of the thing. They deliberated for two months. York was asked a million and one questions by experts and technicians who were called upon to give their opinion. York was patient until they asked him if there would be danger.

"Danger?" he snorted, eyes ablaze suddenly. "No more than in any other human endeavor. No more than the pioneers who first settle a wilderness. Or to the man who first landed on Pluto with a clumsy ship. Or to the dawnman who ventured into the next jungle. All progress is hard won. It is the human heritage. It is not a question of danger—it is a question of courage!"

The grant was given. The parts for the great ship were manufactured at various centers of industry on Earth and shipped to the assembly ground York had been granted, near Sol City, the capital of the Solarian Empire. Under his watchful eye, it grew as a zeppelin-shaped craft a mile in length Its interior was a maze of machinery patterned after York's superscience. Only he understood their full possibilities.

Five years later it was launched, manned by a thousand picked spacemen and technicians. It rose into the sky like a mammoth cigar and lumbered off into space. As it left Earth, its great bulk delayed the next eclipse of the moon a hundredth of a second —the only man-made thing ever to do this!

CHAPTER IV

World Remade

YORK, alone with Vera in his private cabin which was perched like a conning tower above the nose, took pride in giving the orders that were to make a vision in his mind become reality. The Gargantuan ship eased past the orbit of Mars and approached the

asteroids. Soon it passed asteroids which were far smaller and lighter than itself. Finally, the *Cometoid*, as it was named, hove to before Ceres, the largest of the asteroids, some 480 miles in diameter. A small colony of miners had already been safely taken away by another ship, leaving it deserted of human life.

The thoughtful-eyed man at the nose of the ship barked commands. A microphone carried his voice to all parts of the ship. A thousand men jumped to their duties. The ship's stern lined itself with Ceres. An invisible bond sprang from ship to asteroid. The ship moved, towing the miniature world with it. The space-tug pointed for Venus and gathered speed.

Ceres, carted those 250,000,000 miles, was installed in an orbit close enough to Venus to allow its brilliant reflection to shine through the misty atmosphere. Thus Venus was given a moon to the delight of its warmth-loving inhabitants. The success of the macrocosmic engineering feat gave York the same sublime feeling he had had a thousand years before, when he had first realized he was immortal. It was the beginning of a revamping of the Solar System. The astro-engineers of the *Cometoid* piloted their ship back to the asteroid belt and picked Pallas away. This 300-mile planetoid was given to Mars as a moon, to supplement its two tiny, inconspicuous ones.

Then something else was tried. York, long a lover of the majestic beauties of deep space, knew the value of beauty in man's life. The brilliant spectacle of Halley's Comet—faithfully returning every seventy-six years for untold centuries—inspired the next Herculean task. If a comet was such an entrancing panorama when it passed close to Earth or any other planet, why not make this spectacle grander and oftener?

No sooner said than done—with York and his science. Calculations of almost infinite intricacy gave the elements of an orbit that would bring the next comet closely, but neatly, by Earth, Venus and Mars. It was not much of a trick, comparatively speaking, to fasten the end of a force-beam to the comet's nucleus and drag it into its new track around the Sun.

The first one, unfortunately, was lost in the Sun, but the next eight were more carefully warped into their new grooves of motion. After that, all the peoples of the inner planets—which held the bulk of the Empire's population—were to be treated to brilliant cometary displays at least once a year.

The Empire applauded this miraculous bit of Universe-building and waited avidly for the next. York next directed his wonder-ship out toward Jupiter. This great planet's nearest satellite, a small one, was evacuated by its small population and dragged to within two diameters of the primary. There was some doubt over the issue but finally the giant planet's gravitational stress obeyed the immutable laws of space and ripped the body to shreds, slowly scattering them in ring formation above its equator. Thus Jupiter had the same halo of glory Saturn had enjoyed for countless ages.

York's next undertaking was to give Mercury a period of rotation. Burying the end of a force-beam deep within Mercury, as an unshakable anchorage, York diverted the tremendous gravitational stress of the nearby Sun to one side of the planet. York's ship acted only as the medium of transfer of energy, not as the actual mover. Like the copper wire leading electricity to the motor, York's engines tapped the cosmic tanks and poured their world-moving powers into the field of operation.

SLOWLY but certainly the surface of Mercury began to rotate under the Sun's rays. Two years of this finally gave the Sun's first planet a day and night of forty hours each. With the more equal distribution of sun-heat and space-cold on its two formerly unmoving hemispheres, the entire planet was made habitable, instead of just the narrow twilight zone. It went into the annals of the Empire's history as a unique experiment in world-moving.

Then York revealed for the first time that he had atomic power available on his ship—the form of energy that had stubbornly defied man's efforts to pry it loose from its matrix of matter. He must be truly a god, he who had that!

York embarked on the second part of his superproject of interplanetary landscaping. Much of Mercury's surface was given a baptism of supernal fire. Atomic-powered pulverizer-beams transformed its hitherto drab, uninspiring harshness of rock areas into a garden bed of nutritious soil. Hardy plant forms were later to be sown abundantly, to soften the bleakness of the vast calcite plains.

Moving to Venus, York clarified its smoky atmosphere by chemically stripping from it millions of tons of water vapor, carbon dioxide, and the granite dust that arose from its violent wind storms. This took five years, positioned high in the atmosphere, spraying waste products out into space at a speed which insured their departure forever.

Mars was next carefully surveyed, for the purpose of filling its long empty sea bottoms. By repair and extension of its monumental canal system, some polar water had been forced equatorward by the colonists. But only a faint trickle had got into the sea bottom. Warning everyone away from the polar regions, York swung a tremendous heat ray down on the age-old ice.

With a master's touch, he produced a head of water that snaked over the flat lands and eventually poured into those ancient hollows that may once have floated a lost civilization's ships, millions of years before. The process, repeated at the other pole, filled the sea bottoms to great depths and duplicated on a miniature scale the oceans of Earth.

All these feats on a planetary scale were measured in years. At times the *Cometoid* had to be grounded for repairs, refueling, restocking with supplies and men. For men died in this service, with the passing years, and had to be replaced with younger, fresher forces. But York and Vera, eternally young, knew nothing of the passage of time except as a mathematics of the mortal mind. To them, the rebuilding of the Solar System filled the space of a day in their long, long lives.

York turned the *Cometoid's* blunt prow toward the major planets again. Jupiter's poisonous atmosphere was swept clean of its venomous gases by a series of enormous suction machines, like vacuum cleaners, which converted the obnoxious molecules into solid precipitates that fell to the ground. Because the Jovian planet was such a huge one and its atmosphere so extensive, this cleansing took ten years. But for future ages, people would be able to wander freely over its tremendous surface in their levitation shoes.

Io, Jupiter's moon, was scoured sweet from its deadly, tenacious fungi by a tongue of protonic flame.

Saturn's ammoniated atmosphere was suitably neutralized by a two-year belching forth of hydrogen-chloride gas from leviathan gas chambers. York's chemical stores were all produced by transmutation of nearby and often surrounding raw products.

THE bitter coldness of Uranus' frosty surface was relieved by deep and wide shafts that brought up the planet's internal heat. York dug the shafts by means of a pillar of livid atomic energy that disintegrated matter at almost the solar rate.

Neptune offered the tricky problem of being completely covered with a hundred-foot layer of solidified and liquefied gases. This had not prevented daring souls from living in this inimical environment in completely self-sufficient arks that floated over these bitter seas. York did not pass the challenge. After all the residents had been warned away, he dropped innumerable bombs of atomic flame deep in the frigid fluid wastes.

For two years Neptune was a flame in the heavens to rival the Sun as the brilliant atom-fire burned its way through all the surface sea, dissipating most of it into space. The planet's true surface was revealed for the first time in incalculable ages, to become the dwelling grounds in the future of Earth's ever pressing hordes.

York carried his mighty tools lastly to remote Pluto, some four billion miles from the Sun. Perhaps in the future, man, who could carry his air and heat with him, might find reason to inhabit this dark and cold planet. Here he chiseled down and smoothed over a surface that had been violently tossed into jagged upheaval by the long-ago interaction of its molten mass and the sudden chill of space.

When this was done, York raised the *Cometoid* above Pluto and contemplated his work, here and in the rest of the Solar System. He felt a deep glow of pride. Then he swung his eyes out beyond Pluto, out toward the distant immensity of interstellar space. Into his eyes came a strange look, a yearning for the greater freedom of the macrovoid.

"Our work here is done," he said to Vera.

"Yes," said Vera. "Well done." She too was gazing out at the unplumbed infinity in which they had lost themselves for a thousand years—for a magnificent second of eternity.

"We will go out there soon," said York. "By the way," he continued, "how long have we been at this work—in the time scale of Earth?"

"Fifty years," answered Vera. They both laughed, then, at the meaningless words.

The giant, blunt ship left Pluto and with ponderous grace hurtled toward the dim, distant Sun. York landed it at Ganymede for repairs. It was here that he heard the news of Mason Chard's escape from imprisonment.

"I knew that would happen," he said to the Councillors, shaking his head. "You should have executed him. Now you will have him on your hands again, stirring up trouble for the next thousand years, as he has for the past thousand. Well, that is your problem. If I knew any way of finding him, I'd go out after him. But of course, he's far too clever to run across my path again."

ESCAPE had seemed impossible, at first, to Mason Chard. He had been isolated in an underground laboratory on Jupiter's sixth moon, watched over day and night by armed guards. The exits above had been policed, and overhead a Space Patrol ship had kept close watch for possible rescue by confederates.

But Mason Chard had had no confederates. He had at times hired unscrupulous men in certain projects, but never had he entrusted them with his full plans or retained them. Immortal and conceited, he felt himself above human ties. He did not know the meaning of the term friend. As a lone wolf he had pursued his way and so it would be to the end.

For fifty years he had waited for his chance to escape. His scientific endeavor for his captors, on which promise he had won his life, amounted to little. His was not the keen scientific brain, but simply an average one. He was, in the last analysis, a common man with the gift of immortality. He had amused himself in the past thousand years in the way a coarse mind would—by playing god with the people whom he outlived century after century.

Chard's escape was typical of his ruthlessness. He had surreptitiously put together bit by bit a miniature of the same weapon he had developed for his space ship. It charged itself with the energy of the cosmic rays and was able to release it in short, concentrated blasts of exploding neutrons, before which nothing human could stand.

Chard killed his personal guards without compunction. Donning a space suit, he made his way to the exit and burned down the three men there. When the members of the landed Space Patrol ship came on the run to investigate, the superior range of his weapon gave Chard the victory. Their ship was his means of escape from the sixth satellite.

Chard allowed all the bitterness of his fifty years of incarceration to come out in one short, harsh laugh, as the prison satellite faded from his view. They would pay for the humiliation it had cost him, these mortals! When York had left the System and gone far out into space, then Chard would act.

The Immortal had not been out of contact with events in the Solar System for years of his imprisonment. He

had been granted the use of a radio and televisor and had watched with avid interest York's re olding of the Solar System. Safe in his secret hideout in the deepest crater of Earth's moon—which had been unmolested for the fifty years of his absence—Chard now watched the ceremonies attendant to York's landing on Earth, his mission finished.

"Why has he done all this?" wondered Chard. "Is he planning to ingratiate himself with the people of the Empire, so that they will offer him a throne? Has he come back from remote space to wrest from me my dream of ten lifetimes?" Always theatrical in his thoughts, from a thousand-year inflation of ego, Chard's eyes blazed as he concluded: "Is there to be a battle of the gods for this kingdom of mortals? If so, let *him* beware! He has bested me once, by a trick, but I've not tested my full powers!"

Despite this boast, however, Chard felt a strong relief as the televized image of York, standing on a tall marble platform before a sea of faces at Sol City, said:

"People of the Solar System! As the city-planner levels and prepares his city-site, so have I prepared the Solar System for the future Empire of mankind, and his subject races. But when the city-planner is done with his work, he does not seek or accept the rule of the city he has made possible. That is for the city itself to do. The Supreme Council has offered to relinquish authority. You people have petitioned me for ruler. The crown has been offered me, but I must decline, even though it is the greatest crown in the history of man. We are going out into fathomless space again, my wife and I. It is our destiny!"

CHARD'S eyes glea ed in satisfaction. That would make things simpler for him.

After the crowd's low moan of disappointment had subsided, York spoke again, waving an arm toward the huge, shining bulk of the *Cometoid* nearby in its landing cradle.

"I leave you this legacy," he said. "It is an instrument which may yet prove of further use to you. I have left full and complete instructions for its operation and functions in the control chamber. I only ask that you practice care when you make use of the *Cometoid*. It can be a mighty engine of world-destruction, if used wrongly, or carelessly. Its powers are like the sinews of Jovian-sized Titans. Rightly applied, on the other hand, it can be of inesti able utility, in ways comparable to the things I have done with it in the past fifty years."

Chard's eyes had narrowed, looking at the *Cometoid*. The thoughts it conjured up were so intense that he failed to hear York's short and final farewell speech. He was suddenly aware of the televisor scene broadening to show a tiny, globular ship leaping into the sky. A million awed faces watched it dwindle to a pinpoint glistening in the sunlight, and then vanish completely.

As they arrowed away from Earth, the immortal couple were silent with their thoughts.

"You have done a great work, Tony," said Vera. She kissed him impulsively. "They will not forget it for all the ages to come." A slight frown came to her face. "But, Tony, do you think it wise to leave the *Cometoid* in their hands? It is such a powerful thing. And they are like children at times."

"Yes, it is wise," said York softly. "It is the only way."

Pluto rolled by their ports after a time. Behind lay the nine-world empire of man. Ahead lay the vast void.

CHAPTER V

Worlds at Bay

MASON CHARD bided his time patiently. He would wait a full year for York to plunge far, far into the void. So far that no chance message could leak out to him and bring him back. For the success of his present plans, it was essential that the one being who could possibly disrupt them was totally out of the picture. Mason Chard waited a long year, a year that

seemed longer to him than the previous hundred had been.

In that time, he perfected his plans with a finesse that assured triumph, barring a remote unlucky chance. Delving into the vast worldly riches he had accumulated throughout his extended lifetime, he circulated among the scattered space-ports. Keeping his identity utterly secret, he hired a man here and there. He picked them carefully — bitter, disappointed souls whose careers had not been untainted, yet whose abilities as spacemen at one time had been, or still were, respected. Knowing human nature as he did, from a thousand years of observation, he could readily choose men whose cupidity was great and conscience small. Swearing each to utter secrecy, he had them congregate quietly and singly, as he met them, at his Lunar lair.

Through the centuries, he had at other times banded together similar groups, at the other hidden quarters throughout the Solar System. Yet never before had he picked so carefully, nor so many, nor for so stupendous a reason.

At last he had over two thousand men under his banner. Finally, with the entire band before him in his Lunar headquarters, Chard revealed his identity. The hardened, laconic men-of-fortune were not too surprised.

But when he laid bare his reason for having them together, they were completely dumfo ded. It was something that made them gasp. Chard spoke at some length. Surprise gave way to interest. Interest to avarice when he began to list the rewards that would follow. When Chard saw that he had won the majority over, he requested those who wished to withdraw to step away from the main crowd.

Some twenty men gathered together at one side of the huge underground chamber, expecting safe departure in return for a promise of secrecy. Chard calmly pulled out the hand weapon in his belt. A livid beam of exploding neutrons sprang toward the unlucky men, sprayed back and forth. In a minute a score of blackened bodies sprawled grotesquely. When the last screams of agony had died away, Chard sheathed his gun and turned to the silent group who had watched this wanton carnage.

"That," he said ominously, "is to prove I mean business."

THE large armed force guarding the giant drome that had been built around the *Cometoid* was not prepared for the sudden, vicious onslaught that came out of the night sky. A half hundred silent ships dropped in their midst and sprayed fiery death. While this was going on, half the ships landed next to the drome and deposited small figures which scurried into the huge structure, blasting their way through metal walls with powerful heat-bolts.

Mason Chard himself was in the lead, closely followed by a dozen men who had been part of the crew of the *Cometoid* years before. With their knowledge, they showed the way to enter the ship and swarm up its miles of corridors, by rail-car. Each of the dozen who knew the intricacies of the ship led a separate party in a separate direction.

An elevator took Chard and one other to the master control room. Quickly the other explained. Chard, veteran of space travel for a thousand years, soon had a working conception of the incredible craft's controls. York's amazing genius had reduced them to comparatively few. Then the ship's local communication system was switched on. In a short time, various sections of the ship began reporting that the men had grasped their duties and were ready to execute them.

Chard snapped on the exterior vision screen and the all seeing electric eye beyond the drome. The guard had been utterly routed. Then he saw a unit of Earth's air police swoop down from the sky, answering an alarm. He watched as the half hundred well-armed ships staved off the more numerous attackers. The battle went on for long minutes. When reinforcements for the police arrived, the end was inevitable. But so Chard had expected. It had all been timed to the last minute.

When his ships outside had been cut down to half under the blasting guns

of the police, Chard received the final report from the last, remote corner of the huge ship. He barked orders. A steady, low throb rumbled in the bowels of the great vessel, and its walls began to vibrate from the birth of great energies.

When the last ten of his outside ships broke under the police onslaught, Chard grasped a lever with a sweaty, but confident hand; pulled it over. The mighty ship leaped from the ground, grinding the drome to shreds. Chard left his remaining, defending ships to the mercy of the air police. He grinned sardonically to think they had believed he would bother to save any left after the battle.

The *Cometoid*, a juggernaut of space, rose from Earth, manned by a thousand unprincipled scoundrels, captained by a ruthless, immortal demon. He might have been a demon from the way his evil eyes gleamed redly in triumph as he directed the captured ship toward the barren reaches beyond Jupiter. Here, where passing ships were rare, the *Cometoid* hovered for a month, while its new masters familiarized themselves with it.

Chard had not slipped up on anything. He had known from spies that the ship was well-stocked and fueled. He had known that its creator's instructions on the full operation of the monster craft were stored in the helmroom.

Chard was astounded at the full scope of powers at his disposal. Sweeping atomic rays that could eat their way to the heart of a planet. Giant plants that could produce millions of cubic feet of violent gases, given suitable raw material. Powerful force-beams that could grip mighty Jupiter himself and yank him from his age-old orbit. Energy-conversion machines which could store the dynamite of cosmic radiation and the slow, infinite power of gravitation.

Chard realized he had a truly god-like instrument in his hands, one that could make him master of ten universes, if he wished.

CHARD'S stentoriar. all-wave radio voice that burst into the broadcast channels of the Solar System carried the most startling message in all history:

"Mason Chard, the Immortal, speaks! I speak to all the Solar System, and to all of its so-called ruling element. My ship, the *Invincible*—formerly the *Cometoid*—hovers over the moon of Earth. You all know the illimitable powers of this ship, but I invite the eyes of Earth to watch the center of the moon, the mountain range known to astronomers as the *Apennines*. Watch it for the next hour!"

Millions of eyes on the night side of Earth watched and saw a small spark blaze in the center of the Lunar disc. It grew and widened until it was a fiery, incandescent diamond, spewing out a shower of sparkles that spattered over the entire moon's face. Some terrific holocaust of supernal fire, comparable to the Sun's blazing furnace, was creating a deep, molten puddle on the moon!

Then the sparkles ceased and the voice continued: "This same beam of atom-fire can quite readily be focused on any city or spot on Earth, to reduce it to molten matter that will not cool for a week. Or on any planet in the Solar System! The *Invincible* has moved from the moon to Earth. It is now hovering over Sol City. Nothing can save it, if I decide to destroy this citadel of ruling power!"

To himself, Chard added: "Not even the once timely York, who is now trillions of miles beyond reach."

After a suitable pause, to allow the poison of fear to invade their minds, Chard continued:

"Does the Supreme Council of Earth, doomed at the flick of my finger if I so will it, have anything to say?"

Chard laughed triumphantly—

"No, but I have!"

Mason Chard choked in his laugh. Had his ears tricked him? Surely that had not been the voice of—

"Anton York speaking!" continued the quiet voice, inexorable as the stars. "Chard, you've just signed your death warrant. I knew you would try this sort of thing again. Unknown to you, the Council and I arranged, before I left Earth, to leave the *Cometoid* reasonably open to capture. You went for

it, like a bee for its hive. You've been tricked, like any stupid fool. But it was necessary, for I could not leave the Solar System knowing you were at large, scheming. I've been hovering just beyond Pluto for the past year, waiting to trap you. It would be best if you would just quietly land the *Cometoid* and surrender yourself."

Chard's emotions racked his body. Dismayed to the roots of his being, his mind reeled on the verge of madness. A bitter acid seemed to eat its way to his brain and dissolve it. His gigantic ego wilted as overgrown weeds wilt under a hot sun.

His hand touched cold metal. It was a lever that could release, in one stellar blast, the awful power of tons of matter. Could York's little ship withstand it?

Chard sneaked a hand to his vision screen and twisted its knob rapidly. While the Solar System held its breath at this battle of wills between gods, he searched for York's ship. Presently he found it, a ridiculous pebble alongside the supership. Chard whispered orders into the local phone system, careful that his radio transmitter was off. Down below men fed giant powers into huge engines. Up above, a flaming-eyed man waited for the final moment. When it came, he jerked his levers with a desperate finality.

The frightful blast of energy that issued from one vent in the *Cometoid's* broad side engulfed York's ship and rammed it a mile backward. It should have blasted it to atom-debris. Chard turned a greenish white, for the little ship stopped, darted gracefully upward, and came back fully as fast as it had been flung away.

"Naturally, Chard, I was prepared for that," came York's unruffled voice. "Out in interstellar space, my screens have withstood forces far greater than those you've just released. Want to try again? But I warn you"—here for the first time the voice became a little ugly—"you will die sooner that way!"

Chard screamed a series of orders to his crew. The men, unknowing of anything going on outside their respective cells, obeyed with trained alacrity, thinking, if they thought at all, that perhaps the Space Patrol had attacked and needed a lesson.

All hell burst forth from the giant ship hovering over Earth. Some of its tremendous thunderbolts of destruction crashed down upon Earth's surface and gouged it horribly, killing many. But the ship at which the hell-borne fury was directed continued to gleam in the starlight. It was no longer buffeted by the flaming energies that pounded at its protective screen. York had fastened a force-beam to the center of the ship. Now he began to swing in an arc, swifter and swifter, until he was revolving about the great ship, held tight by the force-beam.

York knew the ship, knew that its blind spot was in this path. None of the world-destroying forces could touch him here. He was able to open his defensive screen, which did not allow offensive rays to be given out, and retaliate at last. First he dragged the great ship along until it was no longer near Sol City. Then a faintly shimmering violet beam, representing the accumulation of a vast amount of cosmic rays, bit viciously into the hull. As York revolved, it neatly sliced the great ship in two, like a knife cutting a sausage.

Mason Chard, as he sensed what had occurred, became a madman. But the sudden sensation of falling jerked his mind, as great fears can at such times. He died the many deaths he had escaped in his many lifetimes as the ship fell, and knew at last that his immortality was ended. . . .

The two halves of the mighty ship crashed with a sound that could be heard miles away in Sol City. It was the signal for rejoicing.

As their ship sped away from the Solar System, fully stocked for the supertrek in galactic space, Vera sighed.

"It has been so diverting, so interesting, Tony! I hate to leave. It was a cross-section of the great drama of intelligence pitting itself against the blind, immutable forces of the Universe, to carve out for itself a lasting dominion. From the lone, fearful apeman, treading cautiously the threaten-

ing jungles of his origin to the bold, daring man who has placed foot on this last of nine far-flung worlds!"

York nodded. His eyes were misty as he scanned the infinite ahead.

"Yet it is all so petty, so small. There is a more supreme drama for us to witness out *there*. The sublime evolutions of suns and nebulae and the meta-galaxy itself. The riddles of eternity and infinity!"

Already their mental perspective had begun expanding to include the grandeur ahead. Earth and the Solar System receded to a sub-atomic mote in the incredible vastness of the void. A god and his mate were swallowed in its endless depths.

SCIENTIBOOK REVIEWS

WAR WITH THE NEWTS. By Karel Capek. Putnam. 1937. $2.50.

KAREL CAPEK, the man who coined the word "robot" in his famous play "R.U.R.", has written another fantastic satire on the frailties of human nature and civilization in general. This time it is newts, not mechanical men, that upset the world. They were about as big as a ten year old boy, and could learn to talk and work. In fact, they liked to work.

At first their discoverer, Captain van Toch, trained them to dive for pearls, but after an encounter with a nudist film star, the world was well on its way to become newt-minded.

The Salamander Syndicate was organized to exploit them, and they were transplanted to the coastal waters of all parts of the world, where they throve amazingly, soon outnumbering their human masters by twenty-seven to one, with no sign of letting up.

When the newts become an important factor in world politics, Mr. Capek's satire is in full swing.

We are introduced to the highly superior Nordic newts of Germany, to newt linguists and newt philosophers. We read the impassioned manifesto of the Communist Internationale to "all suppressed and revolutionary Newts" of the world.

Through their construction of new islands and new continents, seacoast nations were given new territory for expansion. And then the newts decided to enlarge their territory by blasting away the edges of the Continents, eating ever farther and farther inland to create the shallow seas in which they liked to live.

Thus began the war of mankind against the newts—an extremely hopeless war as well as a fantastic one.

Did the newts win? The author doesn't tell us, but it seems very probable, unless some of the faint hopes that Mr. Capek holds out in his last chapter actually occur.

—P.S.M.

STAR-BEGOTTEN. By H. G. Wells. Viking Press, 1937. at $1.75.

THERE are still flashes of the old H. G. Wells in *Star-Begotten:* A biological fantasia, but to the lover of science fiction the book will be as much of a disappointment as the author's recent *Croquet Player*. In the days when Wells was writing such tales as *The First Men in the Moon* and *The War of the Worlds*, *Star-Begotten* would probably have been developed by him in a different manner, along dramatic and "plotty" lines, with the basic pseudo-scientific premise expanded with picturesque vividness. But here Wells is content to expound his thesis, and to make his characters talk about it, with criticisms of modern life and somewhat vague details of a Utopia that will seem boresomely familiar to numerous readers.

The thesis: The cosmic ray is produced artificially by extra-terrestrial beings, whose experiments are designed to effect such mutations in the genes of the human race that eventually the resulting mutations will bring about the creation of a race truly star-begotten—the children of the alien beings, artificially created. Often children are born who seem *fey*—out of tune with modern terrestrial life, who are considered geniuses or lunatics, but who are actually successful mutations.

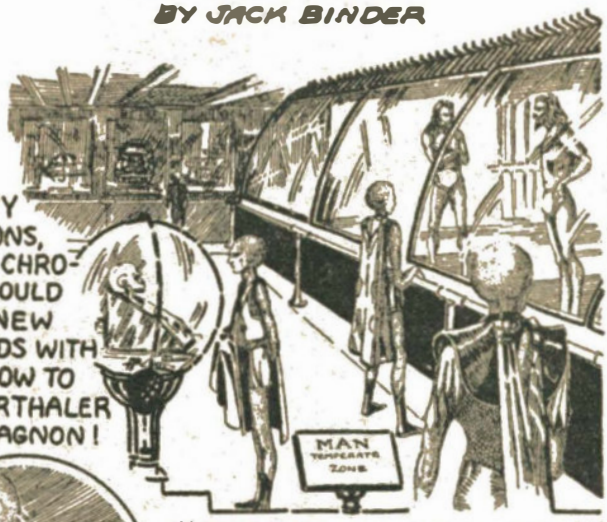
But unfortunately Wells halts here, and devotes the balance of the book to discussion of the possible effect of the star-begotten children on the human race. Possibly Wells has a message which he feels he must convey to the world; at any rate, he is at present an idealistic reformer rather than the grand old yarn-spinner of *The Time Machine* and *In the Abyss*. That he still has his fertile imagination is evident, but he no longer writes what can be termed true science-fiction, in the sense that *Last and First Men*, *The World Below*, and *To Walk the Night* are science-fiction. He prefers to mount a soap-box and preach, and he is not a great preacher. There are many writers who can expound sermons, but few great fantasy authors. As a novel *Star-Begotten* is prolix and inferior to many of similar type; as science-fiction it does not satisfy because there's too much Wells and not enough story. Apparently Wells will never return to the kind of tales which first made his fame. A great science fictioneer has become a dull and prosy preacher.

—H. K.

IF

EVOLUTION SPEEDED UP!

BY JACK BINDER



THE UNKNOWN AGENCY WHICH PRODUCES MUTATIONS, THROUGH THE GENES AND CHROMOSOMES OF CELL LIFE, WOULD EVENTUALLY CREATE A NEW SPECIES OF MAN—AT ODDS WITH THE OLD. MAN WOULD BOW TO SUPERMAN, AS NEANDERTHALER ONCE YIELDED TO CRO-MAGNON!

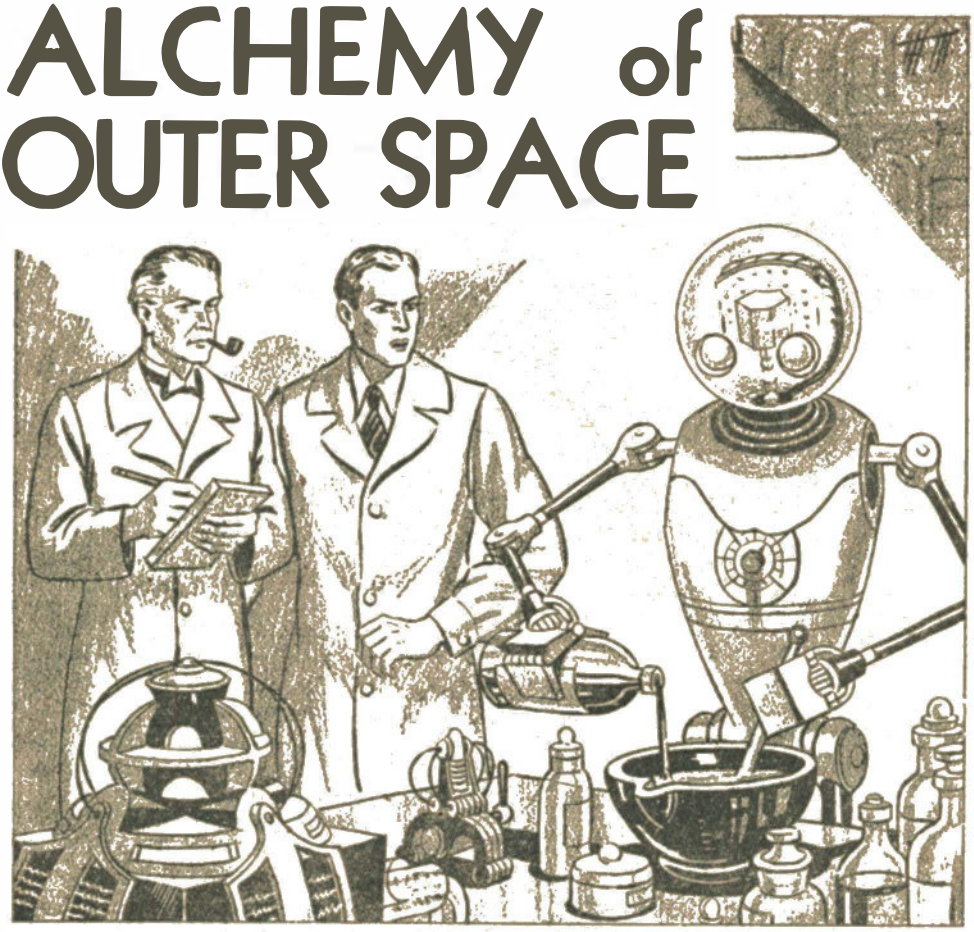
IN THIS NEW, VICTORIOUS RACE, UNNECESSARY PHYSICAL HERITAGES FROM THE BRUTE PAST WOULD HAVE DISAPPEARED—TONSILS, APPENDIX, FINGER-NAILS, TEETH, AND HAIR. SUPERMANKIND'S BRAIN-CASE WOULD BE ENLARGED AND HIS MUSCLES ATROPHIED.

SUPERMANKIND'S SIXTH SENSE OF TELEPATHY WOULD BE SHARPENED. ALL COMMUNICATION WOULD TAKE PLACE BY THOUGHT PROJECTION FROM MIND TO MIND. SPEECH WOULD BE UNKNOWN!

THE NEW RACE TO INHERIT EARTH WOULD BE MENTALLY BRILLIANT. AN ADVANCED RACE WOULD STALK THE SUPER-CITIES OF THE FUTURE. SUPERMANKIND WOULD LIVE MOSTLY IN THE MIND, AND WOULD CONQUER INTERPLANETARY SPACE!

Next Issue: IF THE OCEANS DRIED

ALCHEMY of OUTER SPACE



It seemed to know instinctively the contents of every jar and phial

Horror Stalks When Modern Laboratory Science Produces an Incredible Mechanical Entity from an Unknown Dimension!

By D. L. JAMES

Author of "Cosmo Trap," "Crystals of Madness," etc.

"ERKLESS," said Professor Martery, as I accepted the chair he offered me in front of the black steel desk "I want you to accompany me out to Wyoming. I need your help in carrying to completion a certain line of important research. Possibly you have already formed certain deductions as to the purpose back of our present work—"

I had heard some gossip, whisperings only, which I didn't think necessary to mention.

"No," I an wered, "I haven't. Out there in the laboratory I'm always pretty well occupied. When I complete an experiment I hand in a report. But I know that twenty other physicist out there have been doing that same thing for over a year now. Naturally, I judge that there's something brewing."

Martery didn't answer for a moment. The cosmic-ray counter clicked on and on in the corner of the office. Street sounds came in a vague, muffled undertone. There was a certain austere and withdrawn atmosphere about this office of Martery's, one which gave but little suggestion of its being the vital nerve center of one of the largest research organizations in the world.

Familiar as I was with both the office and its occupant, I had never ceased to note this calm and contemplative influence. It was not the office, of course, but the magnetic personality behind the desk—the big, dark-eyed, square-jawed man, whose hair was just beginning to frost slightly over his temples.

"Erkless," he said presently, "I believe this research we have been making has enabled us to construct a thinking, mechano-electronic brain!"

I need not dwell on the balance of this conversation other than to state that Martery had no intention of letting the newspapers get hold of what he was about. That, I thought, was why he now proposed going into a remote and comparatively inaccessible district to finish the job. Just the two of us.

This seemed very foolish to me. Even should the experiment succeed—which to me seemed utterly wild and improbable—we could, naturally, check the thing at any stage we wished; and later, if it seemed advisable, seek a more secluded spot. But he was adamant in his decision.

"We are on untrodden territory—the frontier of scientific knowledge," he told me. "In these steel files are compiled notes—unintelligible to anyone but me—which hint strongly at possibilities too incredibly stupendous for us to risk taking chances of any sort. It stands to reason that an individual thinking brain would be of little purpose. It must be built into a robotlike body before it can manifest itself. I'm not prepared to carry on unless I can control all factors which might tend to exert an influence. This place is too crowded—too many eyes."

I agreed to accompany him, of course. I need no more than mention our trip across six states, and our entry into the hill country—to that long-deserted farmhouse crouching close against the bare face of a low cliff, and surrounded by an immense area of overgrown brush-land.

Although no one had lived there for several years, the place was in good repair, having formerly served as a hunting lodge for a wealthy sportsman of Moorcroft.

There we found a score of large packing cases that had arrived before us, and which had been stored in the big front room of that rambling dwelling.

THOSE were busy days while we were getting ourselves established and ready for work. Distinctly I recall that first evening. We had had our supper, and were smoking our pipes before retiring—rather early, for we were without lights, although I hoped to get the wiring in before the following evening. The hush and peacefulness descending with twilight was exceedingly agreeable there on that wide stoop, and the full moon was just rising, casting long, finger-like shadows across the cleared space surrounding the house.

I was secretly beginning to congratulate myself that this was the first real vacation I had had in several years.

"This idea of yours looks to me, like a rather abstruse problem," I remarked, by way of starting conversation.

Martery puffed for a long moment at his pipe.

"It would be," he said, "if it were not for the fact that the principle of consciousness lies in basic matter, rather than as a product of organic life."

"You really believe that?" I asked incredulously.

He nodded.

"Some of the world's greatest thinkers have accredited every atom with a kind of soul-life—have tried to explain gravity and attraction in that manner," he said. Then, after a moment's silence, he continued:

"Organic life is just brute matter's attempt to provide itself with sense organs. Artificial radioactivity! That's the answer. Gives inanimate matter a chance to talk back."

"And you think it will?"

"I think it has, already," he corrected me. "Either that, or I've drawn entirely wrong conclusions. The problem is to interpret these reactions, to translate them into understandable motions or signs. I think we have the necessary equipment, already made up, for doing this—although it may require weeks of practical experimenting and adjustment to get it working."

After that there was a long silence, during which I began to realize, almost for the first time, just how strange was this undertaking Martery had planned for us. Maybe it was the odd contrast with the teeming city we had left behind, maybe the moonlight or the stillness which clung around that deserted place—but suddenly the star-dusted sky seemed to draw nearer. Martery had said we were threading the outskirts of scientific knowledge. What lay beyond? Had we learned so very much, after all, of the mystery enshrouding that fundamental cosmic riddle in which we had our being?

Behind the sky, behind that infinitude of space—what was there? What was there four thousand miles underneath our feet, at the Earth's core?

And above all, what did we know of this thing Martery had determined to synthesize, of consciousness — the ability to think, to plan, to reason?

At last I gave it up and went to bed.

It was on the third day of our stay in that ancient farmhouse that I first saw the Brain.

Martery had unpacked all the cases but one. We had chosen for our laboratory a large, airy room adjoining the kitchen—I think it had been intended for a dining room, with a door leading out onto the stoop; and had built a rough workbench and installed considerable laboratory equipment. We had also put up a rude shelf opposite the workbench to hold bottles of acid and an assortment of other chemicals. We were, in fact, well established, and ready to go ahead with the business.

Martery called my attention to that one remaining case, asking my help in ripping off the cover.

It was not a large box, perhaps two feet square. With the cover off, Martery proceeded to remove layer after layer of excelsior packing, until finally he lifted out a round object, thickly covered with cotton wadding.

He carried this object from the front room into our laboratory, depositing it carefully on the bench, and removed the covering of cotton.

Then I saw the Brain.

It was a glass globe, nine inches in diameter, mounted on a brass ring or base. A thick sheaf of fine, insulated wires led into the globe through this base; and on one side of the globe, but rather widely separated, were two platinum rings, inset into the glass, containing round lenses. These lenses resembled eyes, although the transparent sphere of glass in no wise gave the impression of possessing a face.

Now, disinclined as I am to divulge the exact nature of what was within this globe, I feel that this account of that inexplicable tragedy which took place there in the Bear Lodge Range of the Black Hills, culminating in the loss of one of the world's greatest physicists, would be incomplete without a more detailed description.

However, as I have given my word to a certain research organization in which Martery was prominent that I will not aid nor abet in any renewed inquiry along similar lines, I shall surely withhold certain essential details.

I MAY say that within this globe was a glass pedicule projecting upward from the base, and that this pedicule upheld a six-sided prism of pale honey-yellow beryl. When functioning, the surface atoms of this crystal were kept in a state of suspension due to a modulated impact of alpha particles from a source contained within the globe, and this modulation was directly controlled

by fast electrons emitted by the beryl crystal itself reacting on certain suitably placed targets.

Furthermore, there was a curved glass shield, dotted with forty-nine tiny metal studs, each stud being connected to one of the wires which projected from the base.

Martery hoped that once the crystal could be stimulated it would become aware that it could play on these studs with emitted electrons, much as a musician touches the keys of a piano. Also, that it would notice that the impulse imparted to these studs resulted in definite motions of the mechanical body in which he proposed to install it.

I have mentioned two eyelike lenses; I may say that these lenses were placed so as to project images of surrounding objects on two facets of the beryl, which were coated with a film of light-sensitive matter.

But more than this I cannot tell, for to do so would be to court a reopening of something which I hope will remain closed forever. Nor would it be anything more than tiresome to relate how we occupied ourselves for weeks in assembling that jointed, appendaged mechanism of silvery aluminum-alloy which was to serve as the Brain's body.

Again and again I was astonished at the forethought and thoroughness shown by Martery, to say nothing of his no less impressive mechanical skill. Every part of this mechanism fitted perfectly; nothing was lacking. As it grew under our hands, I saw that little effort had been made to have it appear manlike. True, there was a cylindrical torso, upheld by jointed, tubular legs, and provided with two appendages or arms, terminating in metallic, plierlike hands. But there the resemblance, slight as it was, ceased.

When at last the head was finally put in place, the general appearance of the mechanism was sufficiently human to be vaguely repellent.

Then, for several whole days, Martery worked with a soldering iron inside the thing's vitals, connecting the hundred or more wires which trailed down from the brain into the torso.

At last, just at dusk one evening, he finished.

"Now," he remarked, through teeth clenched firmly over the stem of his pipe, "we'll see what we've got!"

I threw on all the lights in the laboratory.

The machine stood there on the floor in front of the bench, and so perfect was it mechanically that, even should the brain refuse to function, it could maintain, or even regain, this state of equilibrium automatically.

"Turn it on," I urged. "Let's see what it will do."

Martery twirled a knob on the front of the thing. I heard a switch click over.

Nothing happened.

That is, nothing happened except for a nebulous blue light which commenced to lap around inside that glassy skull.

I don't think I realized just how tense I was until Martery's voice startled me.

"Right now it's thinking," he remarked.

I don't know why he said that, nor why this simple statement should sound so oddly shocking. I saw no indication of anything unusual. During the moment of silence which followed, I heard Martery drawing at his dead pipe.

"Why do you say that?" I asked.

He didn't answer; but after another long interval he bit off a single word.

"Look!"

He was pointing to the left arm of the mechanism.

Yes, the arm was moving—slowly.

"It hasn't noticed—yet," said Martery.

"Noticed what?"

"That its arm is moving."

"Couldn't that be merely a reflex motion?" I asked.

Abruptly, the arm, which had been rising slowly, dropped. Then the other arm swung forward—dropped. Other motions followed, vague, purposeless.

I ADMIT that at that time I was filled with a profound doubt as to whether these motions were sig-

nificant. At first I attributed them to mere chance, for the machine was in a very delicate, almost unstable, balance.

Minutes fled by. Minutes during which this doubt of mine flamed into a deep awe and fascination.

I doubt if either Martery or I were entirely sane during that first hour. The incongruous aspect of that man-sized mechanism assuming the motions of a human being in such a life-like manner created within me such a mixed sensation of ineffable curiosity and excitement that every other iota of thought was excluded. I could no longer deny that the thing was emerging mentally from that black slough of non-existence into a queer kind of inorganic consciousness.

Those first arm motions were slow, purposeless; then they gradually became more vigorous and directed. Once, indeed, a pincerlike hand clicked harshly against that glassy skull, filling Martery with wild apprehensions, for should that thin globe break, the work of months would be wasted.

Strange that neither of us should have thought to erect a screen or guard around it!

But the glass didn't break, and a moment later the Brain was investigating along the edge of the bench with its metal hand.

Then it walked!

First a blundering, awkward step, then another, and another; each step showing greater mastery and control. Soon it was striding almost easily around the laboratory, its metal feet clumping noisily on the wooden floor.

Martery's condition during these moments cannot be expressed in words. Over and above his realization of scientific achievement was the frenzied fear that his creation would stumble or otherwise meet with some accident, thereby smashing its fragile skull.

I remember yelling at him to turn it off. Profound thinker that he undoubtedly was, this simple expedient hadn't occurred to him. But when he attempted to carry out my suggestion, the Brain, seeing his advance, dodged away to the other side of the laboratory.

"Great Heavens!" cried Martery, his face damp with perspiration, and tragically dismayed. "It's afraid of me!"

He gave up all attempt to approach it.

"It has to be taught," I kept telling him. "Taught—like a child."

Martery denied this. It seemed that I had failed completely to grasp the underlying principles of the thing.

Now, in broken, disjointed sentences, as we watched the Brain fingering tools and bottles and other articles on the bench, picking them up and replacing them with growing dexterity, Martery divulged his theory—such a wild and improbable theory that under any other circumstances I would have thought him mad.

A crystal such as this beryl, he said, was a drawing together of matter into individual units of latent thought. Crystalline structures, with their angles and planes and molecular groupings, constituted the sum total of mathematics, the alpha and omega of electrical, mechanical, and chemical law.

No, the Brain wouldn't have to be taught, he declared; and before that night was over I fully agreed with him.

I don't think that even Martery sensed the tremendous faculty with which the Brain was orienting itself and gaining control over its mechanical body, or of the quickening intelligence that was racing within that electronic ganglion.

Or possibly the Brain did not think—at least in any way sufficiently human to be understood by us. Possibly there was no avenue by which an intelligence so completely alien could be approached.

But it reasoned—and planned! I am sure of that.

The fact that it appeared frightened when either of us tried to approach it convinced Martery that it thought somewhat in animal-like grooves of consciousness. I doubt this, although at that time I didn't doubt that it

sensed the emotion of fear. I don't think that it was afraid of us. It just didn't want to be interfered with—didn't want to be stopped in what it was planning.

So we watched, fascinated, as the Brain continued to move about the place, examining everything with a close scrutiny of its wide-eyed lenses.

Hours passed. It was nearly morning when the Brain first gave evidence of any set purpose other than inquisitiveness. It had found a rather large crucible somewhere.

NOW it came clumping across the laboratory floor with this platinum pot, placing it on the workbench, underneath and in the full illumination of an overhanging electric bulb.

Martery's excitement reached fever heat.

"Heavens!" he gasped, between teeth that were still clenched on the stem of his long-dead pipe. "It's going to mix up something!"

Again the Brain clumped across the floor, returning immediately with a bottle from which it had already withdrawn the big cork.

Martery snatched a notebook and pencil from his pocket.

"What is it?" His eyes were like coals. "Can you see?"

"Tartaric acid powder," I reported in a whisper.

The Brain dumped some of this powder into the crucible.

But before Martery had finished scribbling—he was trying to estimate the amount—the thing was back with another bottle.

Thus that hellish formula was compounded—the Brain clumping to and fro between workbench and chemical shelf, I trying to keep track of the ingredients used, Martery scribbling in his notebook. So quickly did the Brain work that soon we were left in confusion. Never once did it pause or hesitate over a container. It seemed to know instinctively the contents of each jar and phial, for it never examined a label, never measured the amount dumped into the crucible.

Naturally, as tense moments slipped past, we had no means of knowing that this dreadful alchemy was fast approaching its termination. Martery was undoubtedly filled with dreams of presenting humanity with some treasured formula. As for myself, I was too fascinated to do more than stare dumbly at the crucible. Would we find in its rounded bottom a thick nugget of yellow gold, produced through that long-sought art of transmutation?

Martery and I drew as close to the workbench as the Brain would allow. The crucible was half filled with a greenish, translucent liquid.

Again came that thumping, jointed mechanism across the floor, its brain case lambently glowing as its alien thoughts evolved. Again a bottle was elevated over the crucible. I saw the stuff trickle down in a wide stream—

Then I was staggering back in the sudden darkness. The lights had flickered out.

"Lights, damn it!" swore Martery. "What's wrong with your lights, Erkless?"

I groped through the inky blackness toward the switch. Six bulbs had been burning there in the laboratory but a second before. It didn't seem reasonable that they could all have burned out simultaneously.

The switch—that was the trouble. Maybe it hadn't seated properly, had arced across, then broken the circuit.

Hell! Where was that switch? Where was—where—

My groping arms failed to find even the wall!

"Martery!" I yelled.

"Turn on those lights, you fool!" I heard him exclaim somewhere behind me.

I groped forward a step, swinging my arms in the darkness. Another step, still another step—and still no wall!

"Martery!" I gasped, "what's wrong here?"

For a second he didn't answer. Then, from what seemed a considerable distance away, I heard him say:

"I'll find the switch myself. Come back here. What the hell you running away for?"

I turned around, walked a dozen

steps, a dozen more. Nothing! I didn't seem to get anywhere. I stopped, my mind in a daze.

For suddenly, I sensed that I was not walking on a board floor. I saw a tiny, nebulous glow of bluish light receding from me. And while I watched it, it grew fainter—vanished.

I tried to figure out what had happened. Only one explanation seemed possible. I had, in the darkness, hit the doorway. I had walked through the doorway into the yard outside. Of course! That must be the answer.

But I knew that it couldn't be the answer. The door had been closed. Moreover, there were several steps leading from the stoop down to the level of the yard. I had passed down no steps. Besides that, if I were indeed outside the house—somewhere in the clearing—no night I had ever seen could equal this inky blackness surrounding me.

Then I heard Martery's voice. He seemed much farther away.

I answered him dazedly, asked him what had happened. He yelled back that he didn't know, that we were in some "rift" in space, or something. Then he asked if I could see.

I WAS just starting to tell him that I couldn't when abruptly I sensed that I could see, or rather sense, my surroundings. But this impression was too intangible and obscure for me to detect any details.

I closed my eyes experimentally. The impression persisted, became even less uncertain. No—this wasn't vision, but something like it. I seemed to be standing in the center of a vaguely immense, ash-colored plane. I tried to see, or rather sense, the house, and the cliff I knew to be back of it, but only that empty, ashy surface swung around me.

Then I heard Martery calling me again, saying that he would try to join me. Aft r that, at intervals, I kept yelling to direct him, and occasionally he would answer. But gradually his voice became more distant, and finally it ceased.

I find that I am unable to give any coherent account of what happened after that. I remember walking and walking, for what seemed like miles, never getting anywhere in particular.

Once I stopped, tried to collect my senses, tried to reason calmly. Exactly what was it that had occurred?

Obviously, this was some manifestation of that stuff the Brain had mixed up. Possibly some unknown vapor had emanated from the crucible—a gas acting in some abstruse way to dissolve the atoms of matter. Perhaps the Brain had wanted to get away, and had used its alien knowledge coupled with some subtle alchemy in erecting this avenue of escape. And as it withdrew it had inadvertently carried us along with it. Possibly its unhuman reason taught it of some extra space, some ulterior abyss or dimension, uncomprehended by man.

Or possibly the Brain's consciousness had its real existence in some outer space. Perhaps the beryl crystal was but some integral part of a vaster organism proj cted into our three-dimensioned space, a feeler or tentacle, extending along a fourth dimension, which it had chosen to withdraw.

Thus I reasoned. And on top of this came the sudden discovery that my hands and arms—in fact all parts of my body—were invisible to me. I held my hands over my eyes. They in no way impaired that strange sense of vision, for I could still see that ash-gray plane stretching infinitely away in all directions from me.

This discovery seemed to offer an explanation of why Martery and I had strayed away from each other. He was probably as invisible as I was. I determined to try to retrace my steps, and locate Martery if possible.

Again I walked for what seemed hours, calling to attract Martery's attention. Then I gave up calling and just wandered on dumbly.

At last, blundering along in that abysmal, inky rift, I bumped into something.

No—it was not Martery, as I had hoped. It was something waist-high and invisible. Something hard. I touched it cautiously with my hands. A cool, rounded surface met my

fingers. I slid my fingers upward—

The crucible! I instantly recognized the shape.

Yes, there could be no mistake. It was the crucible in which the Brain had compounded that hellish nostrum.

This discovery indicated that I must have wandered back into the space which corresponded to the laboratory. But why was this crucible, of all the objects within the room, including the bench on which it was undoubtedly still resting, the only thing stable enough to be sensed by me? Had it assumed a condition or position of interjacency, like a bridge, leading from Earth into this inky abyss?

But I was in no condition to reason deeply. A sudden rage possessed me, and grasping that invisible shape I hurled it from me—

A CRASH of breaking glass was followed by something that sounded like an explosion; then I was half blinded by—daylight! Daylight—the radiance of a pearly, dew-spangled dawn, sweeping into the laboratory through a smashed window.

I wheeled around. Martery was gone. The Brain was gone. I was alone there in the laboratory.

I don't have to tell any more. You who read newspapers have heard the rest. How back of that lonely farmhouse I found the smooth face of the cliff torn open as from an explosion occurring just within its surface.

And how in that crumbling crevice I found the body of Martery. Martery, crushed and almost welded into the rocks, where apparently he had been wandering in that other space when I spilled the contents of the crucible—thus materializing his body within the rock.

Poor Martery! If I could only have found him—found him before upsetting the crucible!

But the Brain—the beryl Brain? No, that, I feel sure, will never be found. For undoubtedly it has withdrawn itself completely from our three-dimensioned space into that other hidden dimension of which it knew.

Next Issue: THE DARK AGE, a Story of the Last Scientist, by CLARK ASHTON SMITH

A NEW BOOK ON ATOM-SMASHING

ATOMIC ARTILLERY, by John K. Robertson, F.R.S.C. D. Van Nostrand Co., Inc., 250 Fourth Ave., N. Y. C.

THIS book could not have been written five years ago, for the simple reason that the field it deals with first opened up around then. In 1932 the discovery of a new subatomic particle, the neutron, startled physicists into a frantic search for more. The deutron, triteron and positron rewarded their efforts. At this present time, there is evidence of a negatron and neutrino. Harnessing energies of five million and more electron-volts, the "atom-smashers" are beginning to create with these new building blocks, an entire new world of matter.

The table of "elements" of the atom-smashers now includes over 280 different substances, many of which the chemist could not separate, but which are profoundly different in their physical and atomic properties. For instance, one of the new elements is radio-sodium, which can be manufactured at a tenth of the cost of radium and shows promise of being just as useful.

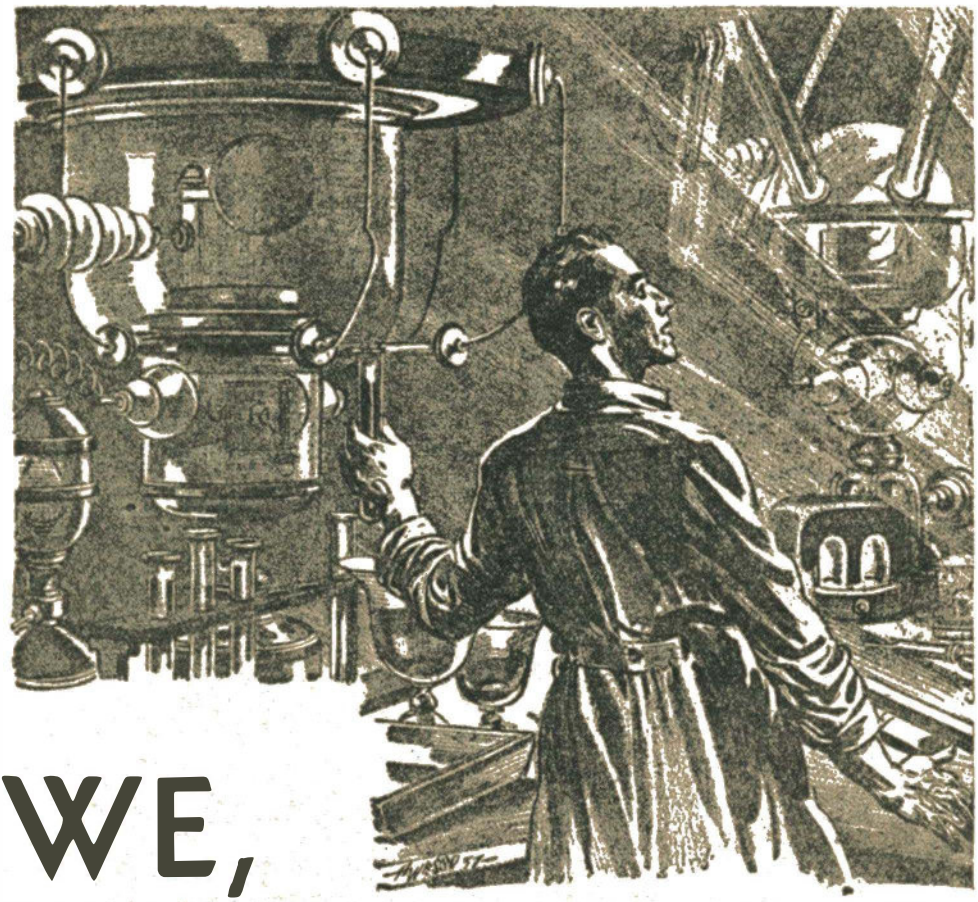
ATOMIC ARTILLERY presents a clear, vivid picture of the very latest developments in subatomic researches. The layman can grasp its principles without undue strain of mind, and he will be amazed at what these modern alchemists are doing. Not many practical results have materialized so far, but they will come in the next decade.

It is the veriest beginning of the exploration of a great new Universe contained in a pin-head. Expensive and powerful machinery has been built, attended by the world's keenest minds, in this invasion of the microcosmos. Why?—one might ask. Because from it will come things as great as radio and the modern parade of inventions.

A significant note is struck at the very end—that the tremendous "atomic energy" of Einstein is an absolute reality, and the atom-smashers may well find a way to draw from its limitless stores. As the author says, may it not come before mankind has settled his many differences!

—E.B.

Radio-Active Beings Invade Earth When



WE, THE INVISIBLE!

A Novelette of Cosmic Forces

By FRANK BELKNAP LONG, Jr.

Author of "The Black Vortex"

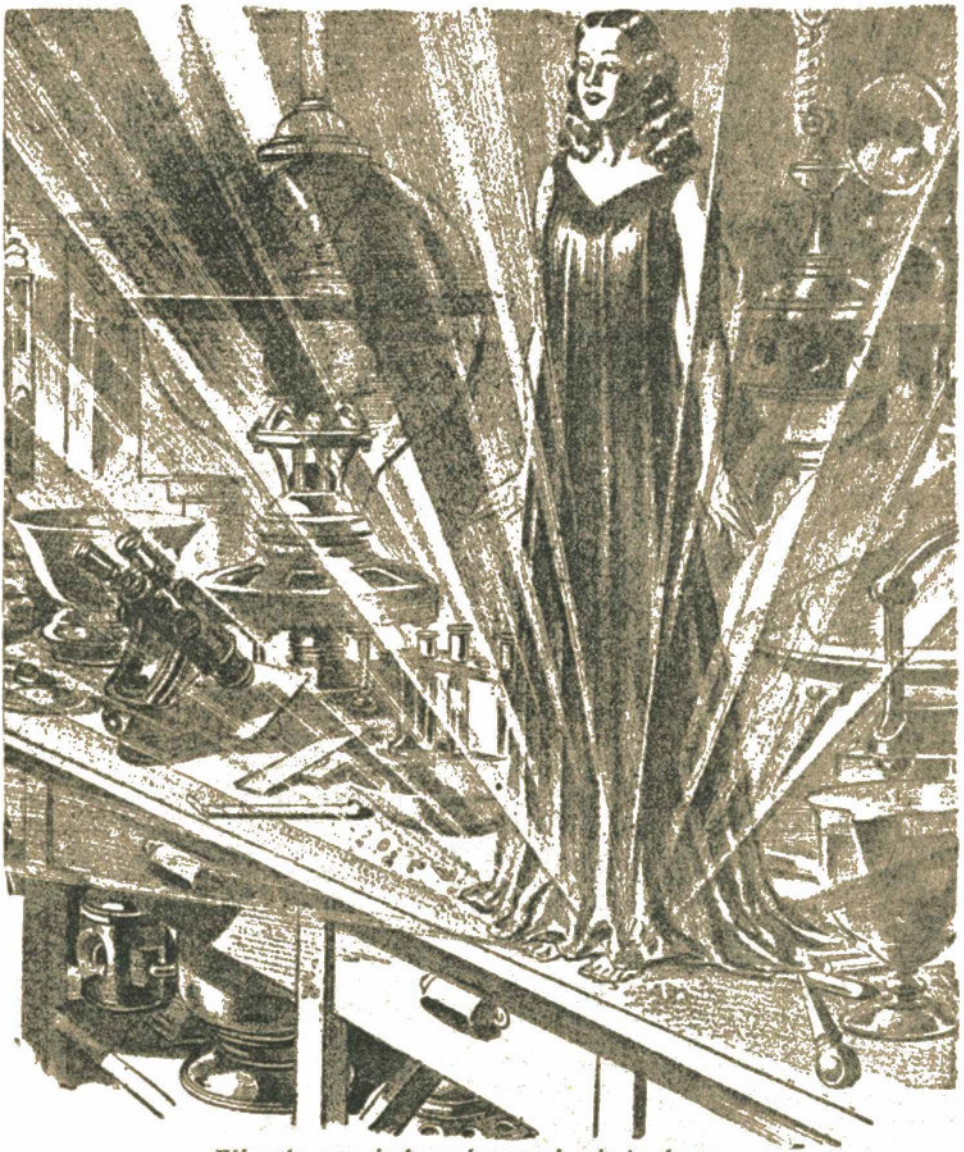
CHAPTER I

The Living Moon

KENNETH Hunter descended from the Wismer transportation tube and strode swiftly along the narrow skylane toward the great silver dome of the Einstein Observatory. There were stains and burnt patches on the dark rubber of his clothes and an ultra-violet ray shield rested on his pale forehead. Beneath the shield his grey, glare-protected eyes were luminous with wonder.

When a Dead Moon Is Resurrected

Matter Is in Turmoil on Far-Off Planets!



When he turned about she was already in the room

Above and behind him the constellations glimmered. Against the Gargantuan backdrop of the night sky he was dwarfed to insignificance, but he did not feel inconsequential as he strode into the pneumatic lift at the base of the mighty dome and depressed the suction disk in the corrugated glass flooring beneath him.

Swiftly the lift shot upward; into a region of crystal power and glory, of immense telescopes trained on the vast ocean of celestial space.

High above Earth's atmosphere Dr. Henry Woodburn sat gazing into the Cassegrain focus objective of the larg-

All Civilization Is Plunged Into Chaos!

est reflecting telescope in the solar system. From the summit of the stratospheric edifice which bore the name of the most gifted astrophysicist of the long past Twentieth Century banners of auroral radiance streamed outward into space.

A little wizened man, bespectacled, blue-eyed, very old, weighing scarcely one hundred pounds, Dr. Woodburn sat unblinking and unmoving at the base of a Brobdingnagian eye of Earth weighing hundreds of tons and gazed at what was happening in the sky—something unbelievable, monstrous, mad. Henry Woodburn did not waste himself on life's emotions. But whenever the ageless heavens revealed unsuspected glories he caught fire and burned with a cold, gemlike flame.

But now the flame was neither cold nor gemlike. It was a white-hot blast of horror in his brain, shriveling and searing him. But so ingrained was his habit of self-control that he remained utterly motionless at the base of the great telescope until young Kenneth Hunter's tall, smock-clad figure came striding toward him.

He sprang up, his eyes like glowing coals.

"Come here, Ken!" he cried. "I need your young eyes. I want you to look at the Moon."

KENNETH HUNTER had ascended into the dome to display a hideous, unbelievable object to his aged friend. Wonder and horror were battling for supremacy in his appalled reason. He had thought to find the little scientist serenely at work, ready and eager to pour the calming oils of skepticism on his turbulent doubts. Instead, a frightened old man was greeting him hysterically and demanding assistance.

Dr. Woodburn drew young Hunter toward the eye-end of the mighty telescope. At the declination axis of the 500-inch reflector a 45 degree mirror cast bright rays from the objective into focus on a revolving eye-piece no larger than a photographic plate.

Surrounded by interlacing meshes that towered to the summit of the dome Hunter settled himself on a wheeled chair beneath the heaviest and widest glass disk ever cast.

In the clear, bright stratosphere, eighteen miles above the surface of Earth, the Einstein Observatory telescope reflected three million times as much light as the human eye and stripped glowing veils from the black spatial gulfs for the mind-numbing distance of five billion light years.

A trillion island universes were riddled by this leviathan "gun of space." The matrix of receding star-clusters so distant that they warped the rim of space were not immune to the penetration of its lidless and unsleeping eye.

It brought the suns of the Galaxy so near that their circling planets swam into view and explosively shattered the human postulate that the solar system was unique in the universe. It enlarged Mercury, Venus, Mars and the outer planets until all their surface features stood out in relief. And it brought the Moon so close that human beings could be seen moving upon its dead and pitted crust, shadowless beneath its brittle stars.

Now it was trained on the Moon. It was trained on the Crater Borda which lies far north of the immense Crisium and Serenitatis Seas, in close proximity to the satellite's northern pole. As Hunter stared at the bright, clear image on the eye-piece his eyes widened and the blood seeped from his face.

The mighty, *extinct* volcano, Borda, was belching fire and smoke! From its wide, dark mouth, hundreds of *toises* in diameter, swollen tongues of leaping flame were stretching thirstily skyward.

Moreover, this lurid upheaval was not confined to the crater alone. The mushrooming crystal domes of an Earth colony twenty miles from the flame-spitting, quaking dome were bathed in livid radiance; were trembling and collapsing one by one.

Within the still intact domes all was terror and confusion. Thousands of frenzied men and women were clustering together on the roofs of transportation terminals and wavering airlanes. Clustering together like bees in a threatened hive, blindly, instinctively. On the eye-piece of the great telescope these doomed were fused, appearing

merely as writhing, dark smudges beneath encrimsoned glass.

In the vicinity of the collapsed and shattered domes the bodies of men and animals lay scattered on the blood-red lunar plain. But here again magnification was mercifully limited, dwarfing the dead and maimed to little, twisted homunculi a hairbreadth in thickness—the microscopic detritus of a catastrophe so stupendous that the whole lunar crust appeared to be threatened by it.

Slowly an electric driving clock shifted the angle of the great reflector until a startled exclamation ripped from Hunter's lips. Near the lunar equator the vast Mare Tranquillitatis swept startlingly into view. It was no longer an airless, Saharalike waste dully reflecting the Earthlight. It was a moving surface phosphorescently aglow. Slowly up its shining banks crawled long, sluglike shapes trailing luminous slime.

THE great telescope moved again until more belching volcanoes brought another cry of horror from Hunter. Everywhere on the Moon's once dead surface flames roared and mammoth sluglike animals crawled from the depths of glowing seas. Heavy vapors, blood-red in hue, hung over Tycho and Vitruvious. Apollonius in the Western hemisphere belched saffron flame. Copernicus was a molten cauldron.

Julius Caesar and Autolycus had been blown asunder by explosions so stupendous that the ensuing tremors had changed the shape of the lunar Apennines, blasting and leveling the higher peaks. So vast and awful were these scarrings that they must have been visible to the naked eye on Earth. Of the eighteen Earth colonies only three had survived the holocaust, and these were in process of dissolution.

Kenneth Hunter was a research chemist. Three miles above the foundations of the stratosphere-piercing tower which supported the Einstein Observatory he had wrestled for five weary months with problems involving the basic structure of matter. Far beneath the mighty telescope, in a white, well equipped laboratory, a simple tray of alkaline solution had yielded a horror as frightening as the holocaust upon which he was now gazing.

But although the vast macrocosm which embraced the universe of stars was no more awe-inspiring in his sight than his own microcosmic world of test tubes and reagents the convulsion of a hitherto lifeless portion of it made him spring white-faced from beside the eyepiece.

"Henry," he croaked, "those big, sluglike things crawling from the lunar seas are exactly like—like creatures that appeared in my laboratory this morning. I came up here to show them to you. In God's name, Henry, what can it mean?"

Woodburn looked at him in amazement.

"But that's impossible," he muttered. "Those Things are at least a hundred feet in length."

"I don't mean in size," exclaimed Hunter. "In shape, in appearance! On my laboratory table I had an eighteen inch tray two-thirds full of radical ammonium. The solution contained considerable sediment—a thick, milky fluid which I had used in a previous experiment. I was examining some *caesium* crystals under a microscope when I heard a curious, splashing sound at my elbow.

"Startled, I stared at the tray. The solution was seething and bubbling like a mass of yeasty dough. Transparent bubbles and little dark blobs of solid matter were forming on its opalescent surface. Even as I stared the small blisters coalesced and two long, sluglike shapes appeared in the ammonium."

Hunter's face was grim, distraught. "The loathsome things did not attempt to climb from the tray, but moved in slow circles in the depths of the fluid. Terror seized me when I realized that I was gazing on living shapes which had been generated out of inorganic matter. My hands shook so that it was minutes before I could grasp a pair of tweezers and lift them from the solution. When I saw them clearly a wave of nausea swept over me. They were revolting, to the point of obscenity—blood-red

and slimy, with three-inch horns and white, viscid eyes that stared sightlessly up at me.

"They squirmed and twisted so that I was compelled to press with the tweezers until the metal bit into their puffy bodies. A bloody fluid oozed from them and dripped into the tray. They made faint, hissing sounds and emitted a pungent, nauseous odor which irritated the membranes of my nose and throat. With unutterable loathing I dropped them into a glass jar containing a forty per cent formalin solution. In a few moments they ceased to move."

HUNTER'S hand went into the loose folds of his rubberized chemical smock and emerged with a two-ounce jar full of pale amber fluid. Floating in the preservative were two shapes so repulsive that Woodburn drew in his breath sharply while his aged eyes sought to focus clearly enough to distinguish the similarities which linked them unmistakably with the immense, blood-hued "slugs" on the convulsed Moon.

For a moment he stared, incredulous, dazed. Then he looked straight into Hunter's appalled grey eyes.

"They *are* similar in structure, Ken!" he exclaimed. "The same stupendous forces are at work here. The same changes are occurring. I think I know what has happened. I was reluctant to believe it at first, but the evidence is overwhelming and it all points in one direction!"

"You mean—you know why the Moon has become a living world again, after hundreds of millions of years?" Hunter cried.

Woodburn nodded grimly. His face was the color of beeswax.

"Yes, Ken. I think I know why this ghastly thing has happened."

CHAPTER II

Dream's End

PLOWING its way between stupendous ice floes, its half-submerged observation turrets agleam with hoar frost and churned spray the suboceanic patrol vessel, *Avila*, approached the northern pole.

For ten hours the long, tapering craft had remained close to the surface of the ice-encumbered sea. Commander Hector Leeming stood waiting for the order to submerge. The order would come, in short waves from the capital city of the United States, across thousands of miles of bleak arctic wastes, and Commander Leeming knew that when he obeyed that order he would skyrocket himself to glory.

Close to the northern pole, at the bottom of the frigid arctic sea, the President of the United States sat in absolute darkness, alone, helpless, imprisoned. Before him sat his young and lovely wife, Elizabeth.

President Gayle was a young man in his late twenties. Anthropologist, explorer, economist, his keen and ruthless intellect had stripped the institutions of his countrymen of all dross and all illusions. A great nation, scientifically regenerated, warless, crimeless, cooperative, almost worshipped this man who had loosed Promethean splendors on the land of his birth.

But now he sat helpless and wretched under thousands of tons of water, in a suboceanic vessel of experimental pattern, the stern plates of which had buckled into folds. Only one chamber of the collapsed and foundered craft contained sufficient oxygen to sustain human life. In the stern chambers a merciful darkness enveloped the dangling forms of men gruesomely impaled on projecting points of steel.

President Gayle drew his wife into his arms. "They will come for us, darling," he murmured. "They *must* come. If I die now poverty will return. Men will fight and maim and slay again. hey will revert to the blind, senseless cruelties of the Twentieth Century."

Elisabeth Gayle kissed her husband feverishly in the cold darkness.

"Oh, why did you come on this trip?" she sobbed. "Must you test every new vessel yourself?"

"Yes," said John Gayle. "Every vessel, every invention of importance. A soldier in the army of science must be unsparing of self."

Elizabeth Gayle shivered. "I hate science," she murmured. "I hate civilization. They have destroyed my dream of love. I hate—everything for which you have sacrificed our lives."

Fumbling in the cold darkness with a battered but still functioning ring prism transmitter Gayle had revealed his position by radio carrier waves to the entire civilized world. Outside the foundered ship's hull infra-red, selenium-cell cameras embedded in projecting sockets took pencil line pictures of the ocean floor which the transmitting instrument flashed televisually.

But Commander Leeming, in his own suboceanic patrol vessel was not in direct communication with the sunken ship. Distortions in radio impulse close to the pole had prevented Gayle's wireless from striking the *Avila's* receiver.

Only a few grim-visaged officials in Washington were familiar with the relative disposition of the two vessels. While a stunned world waited in tormented anxiety, a message in Government code was spoken across the desolate arctic wastes to the cruising patrol vessel:

"Submerge at once. You are within five thousand feet of the President's ship."

Commander Leeming barked crisp orders at an audiophone and flooded all the periscopic reflectors on the control panel before him with cold light.

The long, cylindrical vessel slanted toward the ocean floor. Mammoth walls of submerged ice took the place of the grey arctic skies on the periscopic reflectors. Dark water swirled about the great undersea craft as it plunged jarlessly into the depths.

STRAINED and grim-faced, Commander Leeming watched the pressure gages rise. From far-off Washington an official spoke:

"We can see the President's ship clearly. Ocean floor fairly level for three hundred feet. Keep to your present angle of descent."

The dark ocean depths were iceless now. Submerged floes no longer threatened the cautiously descending vessel. Commander Leeming talked continuously to the audioplate which transmitted his messages to perspiring, feverishly alert young men in another part of the vessel.

Suddenly the radio was vocal again. In a voice tremulous with horror the faraway speaker screamed:

"Leeming, Leeming, stop your engines! Stop them—blast out the torpedo tubes—anything, anything! Return to the surface at once! A frightful thing has happened!

Leeming's ruddy face went suddenly grey with stark, abysmal fear. The faraway speaker was not given to hysterical outbursts. Leeming knew him well—a soldier of science who laughed at death. A man who had inoculated himself with virulent germs, entered gasfilled chambers, with calm compassion watched men die in writhing torment. Yet now, *now* he was screaming:

"There is a great wall of rock rising from the ocean floor! Directly in front of you, Leeming! Three hundred feet, two hundred—Leeming, Leeming, President Gayle is lost!"

From Leeming's quivering lips words ripped hysterically into the audioplate.

"Henley, McCullen, blast out the torpedo tubes! Obstruction ahead. Two hundred feet. In God's name, *blast!*"

There was nothing more that the commander could do. He sat rigid, staring into the periscopic reflector, his face bloodless.

He knew that he was going to die. There was no time for Henley and McCullen to obey his commands. In ten seconds the ship would strike the wall, if there was a wall—

There was a wall. It looked suddenly out of the swirling, dark water in the periscopic reflector, filling all the opalescent screen.

Fragments of thoughts burst in Leeming's brain as his body shot toward the ceiling. Swifter than time the bright glories of his youth burst in a scintillating shower about him, de-

scended and were quenched in a mind-inundating flood of doom.

The great ship struck the wall at an oblique angle. For an instant it remained intact despite the violence of the concussion. Then it collapsed.

Commander Leeming hit the ceiling with such violence that his skull was splintered into fragments. In falling back, his body struck the periscope reflector, shattering it and dispelling an image of an enormous, sluglike shape which was moving waveringly across it.

Battered and shapeless, its fore section telescoped, the patrol vessel sank jerkily downward to the ocean floor.

On the other side of the mile-high, inexplicably ascending barrier of stone the President of the United States felt his body grow numb from the cold which was seeping into the chamber. His arms tightened convulsively about his wife's trembling form.

"My dream of universal brotherhood is dying," he muttered despairingly. "The world will revert to barbarism once more."

"I am glad," murmured Elizabeth Gayle. "Nothing can take you from me now. Love—love is the great, immortal dream."

"You are as primitive as all women," said the President, a sob in his throat. "But oh, darling, my very dear, I am glad that you are with me now!"

PIERCING the airless ether, one hundred miles above Earth's crust, the ionosphere plane, *California,* was braving the fiercest magnetic storm in the long, valiant history of radio layer travel. The pilot sat tense and anxious, crouched above controls that responded erratically.

The ionosphere plane, a hundred feet in length, was wedge-shaped and covered with the glowing detritus of meteor-crowded space. So intolerably fierce was the particle emission from the solar disk that the pilot's deepset eyes were rimmed with blood. Blood ran from his nose and trickled from the corners of his mouth.

But although the spark transmitter signaled danger he stared unflinchingly ahead, lightly gripping the controls With ominous clicks the transmitter warned him that the currents were converging upon him with a fury far surpassing the gales which raged in Earth's atmosphere eighty miles below the world of menacing "mirrors" through which he plunged.

Grimly he told himself that he must remain steadfast and worthy of *her.* An untiring soldier in the great army of science he had built up a reputation of heroic dimensions through subjugation of self. He must not falter now. Not all the raging horror of an ionosphere storm must sway him.

He saw *her* smiling face in the airless heavens before him; filling all that bleak, high world of the ionosphere where no life was. A hundred miles above the spinning globe where she lived and moved and had her being, her radiance filled all space.

Suddenly the magnetic storm broke over the big vessel. Leviathan surges of energy tore at its wedge-shaped bulk, ripping away its outer plates and changing its course until it plunged earthward in erratic spirals.

Fifteen miles it spiraled perilously downward through the electron-lashed ether. Then the magnetic currents converged more relentlessly upon it and for ten miles it dropped like a plummet between in-pressing walls of invisible force.

But even the ionosphere's unleashed fury had met its match in the valor and ingenuity of man. Seventy-five miles about Earth's cloud-enveloped crust the falling plane righted itself again and swept upward into a region where the ether was no longer tormented and convulsed.

A half hour later, in the wake of the storm, the pilot, face wet with tears and blood, was guiding his vessel through friendly and familiar skies.

"We will dine under the stars in Central Park," he mused. "Through the foliage of trees that were planted far back in the Twentieth Century we will look at the moon. I will hold her hand, recite poetry to her. She will think me a fool and a primitive, but who cares? We will imagine for a little while that we have returned to a simpler, less exacting age."

So engrossed was he in reverie that he did not at first see the curtain of fire form across the sky. When it suddenly flashed upon his vision, stabbing his pupils with its terrifying radiance, the ship was already within a hundred feet of it.

Before his eyes could adjust themselves to the glare the distance had diminished by two-thirds. And before he could move from his chair the ship was being drawn into a raging, aerial furnace hundreds of miles in extent.

A scream tore from his throat as roaring flames reached out to envelop him. He had no time to prepare himself for death. As the awful heat swirled about him, melting all the windows of the ionosphere plane, and searing his flesh till it curled from his bones he could only cry out once, in anguish:

"Ruth! Ruth!"

Then, mercifully, all was erased from his mind; names, memories and the fever of living were burned from his veins. A white-hot crisp of metal, the ionosphere plane fell like a plummet through burning air to Earth.

CHAPTER III

The Great White Spot

"ALL over the world the same stupendous changes are occurring," Dr. Woodburn was explaining to Kenneth Hunter in the great silver dome of the Einstein Observatory. "On the Moon, too. There is a reversal of . . . God, it is horrible! Yet when he warned me I laughed at him. I would not believe."

"Who warned you?" cried Hunter.

Woodburn stood for a moment white-lipped, staring in grim silence at his young friend.

"I have always prided myself that I could remain detached if the heavens fell," he said at last. "But now—now I am behaving like an hysterical old woman."

"Who warned you?" insisted Hunter. His voice betrayed resentment. Woodburn, he felt, was torturing him needlessly. He found it impossible to believe that the incredible phenomena he had witnessed could be checked or averted by secrecy.

"Return to your laboratory and wait there for me," pleaded Woodburn. "I cannot trust myself to speak now."

"But in the name of heaven—"

"Please, Ken, do as I say. I want to —to study Neptune again. There is a faint possibility that Monckton was wrong."

"Monckton!" barked Hunter. "You mean the man who tried to kill you? The fanatic you ejected from the laboratory because he threatened to blow it up?"

Woodburn nodded. "Yes. Monckton wanted me to warn the world. He knew that my warnings would carry conviction." The small scientist drew a long breath. "Monckton insisted he had some sort of ray for deflecting disrupted and disorganized atoms far out in space. He was sure that they would convulse all matter if they collided with Earth and the inner planets. He even claimed—" He checked himself abruptly. "But I'd rather not discuss it now. You've got to leave me, Ken. I want to be alone."

Hunter's face betrayed conflicting emotions—loyalty, reproach, and a fierce impatience. Affection for this great man who had toiled so selflessly to enrich human life contended with resentment. But loyalty triumphed. With set lips Hunter turned and strode swiftly from the observatory.

Alone beneath the great telescope, Woodburn stood staring for a moment at the Cassegrain eye-piece as though loath to approach too near to it. It was no longer a glimmering portal opening on a world of glory. It was an instrument of fearful precision which would confirm appalling doubts—an instrument of prophecy and chill doom.

He was still indecisively regarding it when a voice behind him said:

"I am going to kill you, Henry Woodburn. You refused to listen when I begged you to save the world. Now I no longer wish to save it."

The aged scientist swung about. Standing quietly in the cold light which streamed downward from glob-

ular lamps set high in the dome was a lean, darkly bearded man with the sunken and terrible eyes of a crazed fanatic. Hate flamed in his gaze and in every line of his haggard, heavily seamed face. Utterly motionless, pale as a corpse, he stood with his right arm extended and his bloodless lips contorted in a sneer.

Firmly gripped in his upraised hand was a multiple-gage molecular blast tube which gleamed in the cold light as its Deisan-model projector focused menacingly on Woodburn's small body.

WOODBURN paled when his eyes fastened on that sinister weapon. Yet his voice was calm.

"You will gain nothing by killing me, Monckton," he said. "Neither you nor I can save the world now."

Monckton's lips writhed in an envenomed snarl.

"You did not hear me, Henry Woodburn. I said I no longer desired to save the world. When you had me imprisoned I realized that the human race wasn't worth saving if it respected and revered men as blind as you."

His eyes narrowed in fanatical fury. "I am going to kill you because you might try to save the world. Even now it may not be too late. A terrible upheaval is occurring on the Moon, but so far as I know Earth has remained immune."

"No, Monckton," said Woodburn. "The changes are occurring here, too. I have seen living shapes generated from inorganic matter. You predicted that matter would change, but you thought that Earth would be hurled from its orbit. Something more ghastly has happened. I cannot explain it. There has been some reversal. Of time, perhaps. After hundreds of millions of years the dead Moon has come to life again."

For a moment exaltation flamed in Monckton's gaze. Then his face became envenomed again.

"You could have prevented that, Woodburn. I explained how my ray generator worked. I could have deflected the disorganized atoms before they passed the orbit of Uranus. I could have saved the Earth colonies on Mars and the Moon. I could have saved Earth."

For a moment his eyes glazed reminiscently. "It is strange that no one else sought to subject the eruption of Neptune to spectroheliographic tests with hydrogen red light over a long period of time. I am a layman, handicapped by poor equipment. I have only a ninety-inch telescope and an old-model spectrohelioscope. Yet when the bright white spot first appeared on Neptune's equator four years ago I recognized it as a catastrophe of major significance.

"The white spot was thousands of kilometers wide. For months I studied it. With utter horror I perceived that the stupendous eruption was projecting matter outward through space in radiating lines—matter in a state hitherto unknown in the solar system. The spectrohelioscope revealed that one of these disorganized matter-beams was streaming toward Earth at a velocity so terrific that it would reach up in less than three years.

"I knew that something would happen to the atomic structure of Earth when that beam arrived. I devised means for saving the world. But you derided me. I did not mean to threaten or strike you; I lost my head when you wouldn't listen. I will never cease to hate you, Henry Woodburn. You thought you could bind me to silence by sending me to prison. Fool! Yesterday I escaped from my cell in order to kill you.

"You are familiar with the mechanism of my generator; even now you could dispel a part of the beam, refract it back from Earth. I was mad to confide in you, but it is not too late to prevent you from saving the vile human race."

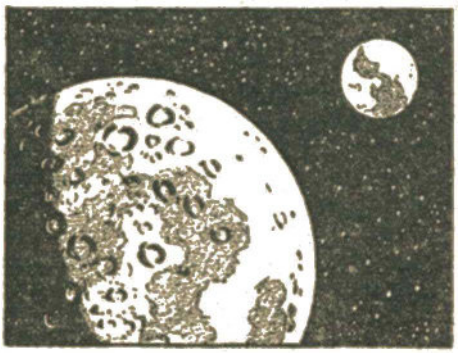
"Listen to me!" said Woodburn. "It is true that I thought you a criminal. You were violent, unreasonable. You threatened to blow up the observatory. In sending you to prison I was merely doing my duty as I saw it. But I swear to you that I do not know how your generator works."

"You lie!" gritted Monckton. "And here is my answer to all your lies and evasions!"

HIS stubby fingers suddenly contracted on the pressure gage of his weapon. A faint hissing sound, like steam escaping, arose from its leveled extremity.

There was no other sound in the observatory. No projection of searing, livid flame such as a positron blast pistol ejects when it works its havoc. The air between Monckton and the little scientist merely seemed to quiver and dance like heat waves.

For a fleeting instant Woodburn's countenance reflected agonized terror. Then a tetanuslike rigidity gripped the muscles of his jaw, jerking his head violently backward and twisting his lips into a ghastly, unnatural grin.



As the molecular blast surged over him the flesh of his cheeks blackened and shriveled until his face became a hideous, leering mask of parchmentlike skin. For only a moment it remained thus desiccated. Moisture oozed suddenly from the blackened pores; streamed over the convulsed lineaments. Individual features melted and ran together. His flesh dissolved swiftly within his clothes, melted like wax in an incinerator.

From the extremities of Woodburn's trousers a black, slimy substance ran out upon the floor. From his wrists black fluid spurted. His clothes sank in clinging folds over his fleshless bones.

Presently only a skeleton in the loose, ill-fitting clothes of the little scientist stood beneath the great telescope, swaying slowly from side to side. A grinning skull flecked with blobs of dark moisture stared sightlessly into Monckton's eyes, glowing with fiendish exaltation. Then the skeleton fell to the floor with a clatter.

CHAPTER IV

The Infra-Radiant Woman

AS Kenneth Hunter descended in the pneumatic lift to his laboratory three miles above a terror-shadowed Earth the yawning air vents of the eighteen-mile-high stratosphere tower flashed past with luminous flickerings. So swift was his descent that the stars appeared as a solid blanket of silver hemming him in.

Occasionally he would be plunged into the absolute blackness of vertical vacuum shafts and subjected to an acceleration which drove the blood in torrents to his heart. Near the three-mile level the lift decelerated in gradual stages while pneumatic pressure brakes absorbed its surplus momentum.

Excitement shone in Hunter's eyes as he emerged from the spherical cage and threaded his way through a maze of corridors illumed by cold light lamps to the sliding steel door of his laboratory.

He passed swiftly inside, drawing the door shut after him as his eyes swept over the laboratory tables. Far above him a little wizened man was speculating on a world convulsed, and he would have to wait—*wait*—in torturing s u s p e n s e while Woodburn studied the heavens in confirmation of his worst fears.

Idly Hunter picked up a test-tube.

For no particular reason he was still examining it when the vibration curtain formed above the nearest of the long tables. He was unaware that the air behind him had begun to shimmer; to quiver. He did not even see the tall woman-figure come w a v e r i n g l y through that screen of radiant force.

When he turned about she was already in the room. She was standing on the table looking quietly down at him, a little, twisted smile on her red lips. She was attired in a single shimmering garment of rainbow-hued cloth,

silky in texture, which opened wide at the throat and descended in voluminous folds to her ankles. Her arms and feet were bare and her unbound hair rested in waves on her shoulders.

Her skin was pale olive; her eyes almond-shaped and shaded by long, dark lashes. High cheek bones and a small, straight nose heightened the exotic cast of features so poignantly lovely that the blood drained from Hunter's face as he stared up at her.

"I knew that some day one of us would come through to your world," she said.

Her voice was musical, bell-like. It tinkled and throbbed with rhythmic, pulsing tintinnabulations which bore only the faintest resemblance to the cadences of human speech.

Behind her the force curtain was obscurely visible. Rising from the table it spread out fanwise above and beyond her slim body. It was a pale shimmering so tenuous its outlines merged imperceptibly with the surrounding air.

HUNTER was so startled that the test-tube slipped from his fingers and fell to the floor with a crash.

The woman's red lips parted and a look of deep concern touched her features.

"Do not be alarmed," she murmured. "For months I have been standing beside you, watching you, loving you. We are invisible to you but your world is not hidden from us."

Suddenly a radiance suffused her pale cheeks. Into her face came a look of yearning such as Hunter had never seen on the countenance of a living woman. She fell to her knees on the table and extended her arms toward him.

"Kiss me, embrace me!" she murmured. "Now—while I hunger for your caress!"

Before Hunter could move her arms were about him and she was pressing her lips to his. Her clinging body and the perfume which emanated from her flowing garments stirred his senses until his whole being throbbed.

Then, suddenly, she pushed him gently from her and looked at him with glowing eyes.

"For thousands of years we have been studying the men and women of your world," she murmured. "But you were only obscurely visible to us. We could hear and smell you, but we could scarcely see you at all. Living forms wavered and receded. Sometimes we flowed through you and increased our knowledge thereby. But always there was a barrier, a veil between us.

"Until today we were compelled to theorize and speculate about you. We have mastered the cadences of your speech, but the very words I now am using do not always evoke clear visual concepts in my mind.

"Our world is a world of intangible energies, of fiercely raging photons of light and infra-gradations of heat beyond the range of even your invisible spectrum. The cells of my body are composed of deutons, neutrons and positrons in dissolution and flux. We are sub-subatomic and infra-radiant.

"Yet we are closely linked to you and in a peculiar sense dependent upon you. You have created us. We are the by-products of animal and human evolution on Earth. When animals and men die by violence on Earth certain tenuous and still undissipated energy patterns are spilled over into our world. Life cannot be cut off abruptly in your world without leaving residue in ours.

"The original patterns continue to exist subatomically in our world. All about you are forms which you have never seen—intangible entities, plants, animals, human beings as vitally alive as you are, but possessing body cells so attentuated that they radiate in invisible photons. *You* radiate in electron-volts."

"But I can see and feel you," gasped Hunter. "What makes you tangible now? How did you cross the barrier to —to my world."

"There has been a tremendous, interior explosion on the planet Neptune," said the woman. "A vast field of disorganized energy has been hurled across interplanetary space. This energy is not sufficiently tenuous to pass completely into our world or sufficiently cohesive to remain entirely in yours. It is a wavering curtain of half-disorganized atoms in a state of semi-

flux. We can pass through it into your world by tapping its radiant core, by *feeding* upon it. With its aid we can build up our infra-radiant body cells until they begin to radiate in electron-volts."

SOLICITUDE shone in her gaze. She seemed anxious to calm and reassure him.

"As you know, all life is radiant energy, radiant heat and light. As far back as the Twentieth Century the scientists of your world were familiar with the electrodynamic changes accompanying plant and animal growth. Every species of animal has a different electrodynamic pattern or picture, which possesses all the characteristics of an electric field and gives off radiations which can be accurately measured.

"Every cell of your body has a charge density of forty-five hundred electrostatic units, and human blood cells have a radiant charge at their surface equivalent to millions of electronvolts. But not all life is so highly energized. Seething life so tenuous that your limited human senses cannot detect its existence has spilled over into our world since the beginning of animate evolution on Earth.

"The inorganic has spilled over too. Radioactive minerals from Earth's buried past; great barriers of carnotite, thorium and lead. There are mountain ranges and seas in our world—lava oceans of turbulent and seething residue.

"Our skies are wrapped in blankets of invisible flame. All the cataclysmically changing geologic past of Earth has left infra-radiant residue in our world. Incandescent patterns spilled over when Earth was a slowly solidifying ball of flame and vast force fields of disrupted atoms tore and ripped at its molten crust.

"Infra-light and the emanations of radium, actinium, ionium are not sufficiently infra-radiant to pass into our world. But these rays, which you can detect with your instruments of science, are not the only by-products of atomic disintegration. For a billion years of Earth-time, colorless, tasteless, odorless, weightless rays have spilled over into our world. When atoms disintegrate radioactively they spill over abundantly, but even molecular changes and simple combustions can produce them.

Hunter's lips were white. "I have just looked at the Moon," he said. "All over the Moon volcanoes are belching flame; there are seas of molten fire."

The woman nodded. "Not only on the Moon. A few hours ago a great barrier of radioactive residue rose from the sea in the vicinity of Earth's northern pole. The air of Earth has burst into flames. Geologic formations that existed when Earth was young have broken through, have superimposed themselves on the newer patterns. In a sense, Time has reversed itself."

"Yet this building still stands," exclaimed Hunter. "There are no convulsions here, no earth tremors!"

"The upheavals were sporadic, fugitive," said the woman. "The Neptunian force beam merely grazed Earth. Only a few barriers rose; a few flame sheets appeared in the skies. Only a few of us came through to your world." Her eyes clouded somberly. "Even now the disorganized force beam is receding from Earth. There are only a few scattered areas left where we can come through. Little pockets of disorganized force scattered across the world, energy vortices, vibration screens. They are thinning, vanishing in the wake of the receding beam."

"But the inhabitants of your world!" cried Hunter. "Are they all—like you?" Incredulity and stunned wonder shone in his eyes.

THE woman shook her head.

"My name is Allala," she aid. "I am of Caucasian extraction, of an old racial stock modified by thousands of years of evolution in our world. There is growth, evolution in our world too. All the races of men are represented there. Since the dawn of human evolution in your world millions of men and women have died by violence with vital energies undissipated.

"Shaggy, apelike types spilled over and evolved. Men of the Old and New Stone Ages, men of the Bronze Age,

men of modern races. Some of the older, more primitive types have been enslaved. We have hierarchies as rigid —and as unfair—as yours. We have ruling castes, emotional, cultural, intellectual. We have scientists, artists, scholars, soldiers, saints, imbeciles and maniacs. Yet our civilization is very different from yours."

"Are there plants, animals in your world?" asked Hunter.

"There is only one animal, the slaggarth," said the woman. "The terrible, never-ceasing wash of animal and vegetable life across the ramparts of our world threatened its very existence until our scientists ended the menace by a process of wholesale extermination. The slaggarth is a gigantic, modified slug, artificially bred. All other animals have been killed off.

"The slaggarth supplies us with food and serves as a beast of burden. Nearly all our slaggarths are bred on the Moon, in the vast basins which were once seas, and are teleported to Earth through the infra-radiant ether."

The woman smiled faintly. "I sent two tiny slaggarths through to you this morning," she said. "I was testing the strength of the vibration curtain. It is strong here now, but at first it was so feeble that only newly hatched slaggarths, tiny forms, could pass through it into your world."

Suddenly the woman swayed and her hands went to her throat. Into her face came a look of startled apprehension which changed swiftly to alarm, to tragic, burning despair.

"I am being drawn away from you!" she cried. "I am being drawn back into my world! The curtain is weakening again. Its radiant core is dissolving, tugging at me. I can feel it tugging, tugging—"

CHAPTER V

The Man and the Tiger

IN a vast, domed arena, Jules Legrain, world-famed animal trainer, stared in horror at his unruly charge. The great tiger reared menacingly on its hind legs, its jaws drooling saliva. The red cavern of its mouth yawned ominously.

The animal trainer's face was beaded with glistening sweat. The long metallic prod in his upraised right hand dripped with feline gore, but the great beast's gleaming eyes showed neither humility nor remorse. In disobeying all of Legrain's shouted commands, in ignoring the cruel lacerations which pointed steel had wrought in the flesh of its quivering flanks it was obeying some instinct as old as the jungles through which he once had roamed.

"Get back, damn you!" screamed Legrain, his face whiter than the immense sea of appalled faces which looked down upon him from the audience tiers.

The tiger's flattened nostrils were quivering with rage. Swiftly it continued to advance across the arena. The thirty feet which separated the beast from Jules Legrain dwindled to twenty-five, to eighteen. Then suddenly the big cat sprang.

A roar of shrieks and groans arose from the audience tiers. A scream tore from Jules Legrain's throat. He threw himself flat upon his face, his only thought to protect his stomach from the leaping cat's cruel claws.

With a snarl the big animal thudded to the floor and sank its claws deep into quivering flesh. Bones crunched sickeningly as dark blood spurted.

Jules Legrain got reelingly to his feet and stared with dilating pupils at a hideous and unbelievable thing—at an immense, sluglike shape which had suddenly materialized out of empty air and on which the great cat was venting its pent-up rage—*not* on Jules Legrain.

For a full minute while the vast audience stared down in frozen horror the striped lord of the jungle tore at its prey with fang and claw. Then the encrimsoned outlines of the frantically writhing shape wavered, grew dim. Beneath the great beast's blood-drenched paws the air shimmered while a paling image of the lacerated horror slowly receded. The blood on the tiger's tawny body vanished also.

The light of maddened frustration

burned in the tiger's tawny eyes. Cheated of its prey, inflamed by its alien blood-feast, it turned slowly until its fiery eyes fastened hungrily on Jules Legrain. With a roar it leaped savagely, claws extended. . . .

IN Kenneth Hunter's laboratory the woman's slender body receded with gradual flickerings until only her face and her little naked feet were mistily visible in the vibrating air above the table. Tenderness and tragic torment looked out of her glowing dark eyes.

"Good-by, my beloved," she murmured softly.

For a moment her countenance lingered waveringly in midair—a vague, whitish oval afloat in a shimmering square. Then the vibration curtain seemed to thicken until the oval became an opalescent dot.

A despairing cry tore from Hunter's throat. He gripped the table edge, staring up at a faintly pulsating curtain of empty air. Helpless and entranced he was consumed with such an intensity of emotion that all about him seemed unsubstantial and unreal.

Only Allala seemed real. Imperishable, immutable, more real than Time and change, her loveliness had fevered his blood that pulsated in rhythm to the beatings of her invisible heart.

"Allala, Allala!" he pleaded. "If you leave me now—"

He did not hear the laboratory door slide open behind him. He did not see the tall figure of Albert Monckton advance into the room, a molecular blast tube in his hand. Death danced in Monckton's mad eyes. Slowly he raised the blast tube and focused it on Hunter's back.

"You were his friend," he snarled venomously. "You share his knowledge. You could still save the world."

There was a faint hiss, as of escaping steam. The air between Monckton and the table quivered more vibrantly than the air above the table. That was all.

Hunter simply swayed a little and slumped jerkily to the floor. The swift dissolution of his flesh occurred while he lay in a crumpled heap on the floor.

Monckton cursed savagely, stamped like a petulant child, denied the satisfaction of seeing terror flame in his victim's gaze. Then he perceived that he hadn't killed Hunter at all.

Hunter was standing on the table with his arms extended as if toward someone unseen. Exultation shone in his gaze. All about him the air was shimmering mistily. Hunter himself was nebulous, indistinct. He seemed to be fading rapidly from view.

Suddenly Monckton saw an astonishing thing. Hunter's arms were no longer empty. There was a woman in them, a tall, dark-haired woman whose lips were pressed firmly against Hunter's lips.

Before Hunter and the woman faded completely from view they faced Monckton as though in gratitude. Their eyes were glowing and their faces suffused with ecstasy.

Monckton had never held a woman in his arms in all the long years of his warped and lonely existence. Hunter's happiness added the caustic leaven of envy to the ferment in his mind. His madness suddenly became all-pervasive, uncontrollable.

With a strangled sob he slid open the laboratory door and dashed from the chamber. Through a maze of corridors he threaded his way in frenzied silence. The pneumatic lift was still standing open when he came to it. He had left it standing open on his descent from the observatory fifteen miles above.

He had intended to kill Hunter and descend to the surface of Earth. But now everything was wrong. Everything! He didn't want to descend to Earth now. He wanted to ascend to the stars, to climb from star to star, to mount hand over hand on the gleaming, bright ladder of the Milky Way.

The open lift yawned darkly, invitingly. Swiftly he stepped into it, released the pneumatic pressure brakes. A sane man, wishing to ascend, would have left the brakes on. Or, wishing to descend, would have released them slowly one by one.

But Albert Monckton released them suddenly. For three miles the lift was a metal coffin plunging through darkness to the unyielding bosom of Earth.

Science Questions and Answers

THIS department is conducted for the benefit of readers who have pertinent queries on modern scientific facts. As space is limited, we cannot undertake to answer more than three questions for each letter. The flood of correspondence received makes it impractical, also, to promise an immediate answer in every case. However, questions of general interest will receive careful attention.

THE OCEAN TIDES

Editor, Science Questions and Answers:

Regarding the ocean's tides and their causes, I believe the generally accepted opinion is that the moon's gravitational attraction is responsible for them. It appears reasonable to me that they could be caused by another agent, namely centrifugal force. This force, of course, is present at the earth's surface, because of the rotation of the earth. It is my understanding that the tides occur periodically, and at the same time each day. If this is true, how can they be caused by the moon which lags behind the earth some 50 minutes a day?

T. C. M.,
Opal, Colorado.

We note that you say it is beyond your understanding that the tides occur periodically and at the same time each day. This, however, is not true by any means. The tides do not occur at the same time every day, but 51 minutes later each day at the same place. It will also be found that the moon comes to the meridian 51 minutes later each day. This fact alone is enough to show a connection between the moon and the tides. The sun also has a part in producing tides on the earth. It has been found that the tide-raising force is inversely proportional to the cube of the distance of the tide-raising body, and directly proportional to its mass. The sun is far more massive than the moon, but it is also much farther away from the earth.

There are many circumstances of the tides that show that they are due to the attraction of the sun and moon. Lunar tides are highest when the moon is near the earth, and the solar tides are highest when the earth is near the sun. Also, when the sun and moon are acting in conjunction at times of new and full moon, the tides are much higher than when the sun and moon are 90 degrees apart at first and last quarter.

High tides occur at intervals of nearly 13 hours, because a tidal crest is formed diametrically opposite to the moon as well as directly under it, owing to the difference in distance of the various particles of the earth's fluid and solid surfaces from the moon, and the resulting difference in the attraction of the moon for them. The waters directly under the moon are pulled away from the surface beneath, and the earth is pulled away from the more distant fluid surface. This produces two tidal crests, one directly under the moon, and the other diametrically opposite. As the earth turns on its axis, these two tidal crests about 12 hours and 51 minutes apart, travel over the earth following the moon.

Continental barriers and variations in the contours of coast lines complicate the motions of the tides. In the mid-Pacific Ocean the rise and fall of tides is very slight. Tides in the Atlantic are propagated by a tidal wave coming from the Pacific and Indian Oceans around the Cape of Good Hope. The tides in the North Atlantic are far more complicated than the tides of the Pacific. The time that elapses from the passage of the moon over the meridian to the next following high tide depends on the location of the port. The height of the tides at any port depends on the form of the coast line at the point and the depth of the water. The highest tides occur when the water is, as we may say, forced into a corner, as in funnel-shaped bays. The highest tides in the world occur in the Bay of Fundy on the coast of Nova Scotia where the outline of the coast is such as to force the waters to a high level.—Ed.

WHY ISN'T THE EARTH UNBALANCED?

Editor, Science Questions and Answers:

I would like to ask you why the earth apparently continues to rotate without any appreciable variation when one-half is possibly heavier than the other.

When large cities like New York are built, heavy material is taken from one part of the earth's surface and added to the other part, and this would make one part heavier.

Coal is taken from the earth and burned, so doesn't that make the part of the earth lighter where the coal is taken? The burning of the coal still lightens the surface.

Why is it that this changing of weight does not effect the cycles of rotation?

Does the center of gravity change when great quantities of matter are transferred?

E. D,
New York, N. Y.

In our opinion, the amount of coal that is taken from different places of the earth and burnt in cities like New York, where the material is massed in one place, is really so insignificant compared to the total mass of the earth that it would cut no more figure than the smallest fly speck would on the largest orange. That would be about the proportion.

While there is a difference in weight, this amount is so small that it would never be able to make any tangible difference. As a matter of fact, very much greater differences occur every day of the year due to snow or rain. These amount to tremendous proportions as compared to the weights of buildings in large cities. Still these differences are so small as compared to the total weight of the earth that they really amount to nothing at all in the long run.—Ed.

WET AND DRY AIR

Editor, Science Questions and Answers:

I have always thought that moist air is heavier than dry air, as seems evident when on foggy days the air or clouds of vapor hang low. Nevertheless, prior to all rains, barometric pressure falls. Can you explain this?

J. M.,
Trenton, N. J.

A liter of dry air at a given temperature weighs more than a liter of wet air at the same temperature. This is true for the following reasons:

1. Water vapor is lighter than air. One liter of air at standard conditions weighs 1,293 grams, while a liter of water vapor under the same conditions weighs 0.8043 grams.

2. By Avogardo's hypothesis, "Equal volumes of all gases at the same temperature and pressure contain the same number of molecules."

3. Therefore a liter of saturated air must contain fewer molecules of air, their place being taken by the lighter molecules of water vapor. A liter of the mixture will weigh less than a liter of the water alone.

4. If a liter of dry air is weighed and then allowed to come in contact with water it will become saturated and its volume will increase, thereby making the weight of a liter of the mixture less than it was before.

5. As the air becomee more humid the barometric pressure falls. If, however, air is saturated with water vapor and its volume is kept constant by artificially increasing the pressure upon it, the weight of a liter will, of course, be more.

Another fact in this connection is the following: If a gas is confined over water, say when the temperature is 20 degrees Centigrade and the barometer reading is 760 millimeters, then the combined pressures of the gas and water vapor present will be 760 mm of which 17.4 mm will be due to the water vapor and the balance, of 742.6 mm to the gas. Therefore only 742.61 760ths of the volume will be gas; while the rest will be water vapor.—Ed.

CAN ANIMALS FORETELL WEATHER?

Editor, Science Questions and Answers:

1. What is the scientific opinion of today of the ability of animals to foretell weather?

2. It is the opinion of some that birds see more clearly because they can detect ultra-violet or infra-red illuminated objects. Is this so?

L. M. P.,
Miami, Florida.

1. The scientific opinion of today is that animals cannot foretell seasonal weather either by the thickness of the fur or in any other manner.

2. It is probable that the keen sense of sight of birds is due to a greater cultivation of that very important asset. Birds, as you know, have been constantly using their eyes to a greater extent than man. A sailor trained at sea and traveling the sea for years, will have a much clearer sense of sight and much keener vision than we landlovers. We do not believe that the infra-red or ultra-violet rays have much to do with the keen perception of lower animals, although when tests were made on dogs, it was discovered that they react to ultra-violet rays.—Ed.

ATOMIC ENERGY

Editor, Science Questions and Answers:

We read much in the newspapers and magazines about the energy residing in the atom; locked up in the atom, etc. Also, if we only could unlock this great store of energy, how we could sling battleships over the moon, etc., etc.

I would like to question the logic of such information. If I understand rightly, energy always works in circuits or the equivalent; there is an outlet and an inlet. The visible emanations of radium are not a measure of the energy passing through it, any more than the sparks from hot iron are a measure of the energy used in shaping it.

The magazines tell us of great quantities of energy coming out of an atom and none going in, and people take it seriously. The case of radium is like that of the magnet; labor or the equivalent of it is used to make the substance a good pathway for the lines of force coming from the sun. When the ordinary electric current is raised in pressure and frequency, new phenomena appear, so with radium No energy is gained, only potency, all paid in work or the equal.

The atomic energy bug is only the perpetual motion crank in another guise.

A. M.,
Brooklyn, N. Y.

We cannot agree with you. Compare a piece of dynamite with radium (for illustration's sake). Both, as far as latent energy is concerned, are quite similar, except that radium gives off its energy slowly but surely. After millions of years it will have turned into lead. If we could realize all its energy

instantaneously, it would prove far more powerful than dynamite, weight for weight. But, as yet, we have not learned how to do it anymore than we can utilize dynamite in a motor for power purposes. In short, dynamite goes off too quickly, radium too slowly. But there certainly is no thought of perpetual motion here.

Now radium is only an element just as a piece of copper. Both contain a tremendous amount of latent energy—a one-cent copper piece could haul a train from New York to Chicago—if we knew how to get at the energy.—Ed.

THE SENSES

Editor, Science Questions and Answers:

1. Are the senses of taste and smell the perception of vibration of any substance? Does mustard, having a keen taste, vibrate at a much higher rate than sugar, which has a dull or pleasant taste? Are the different degrees of taste between these two due to a different rate of vibration in the objects possessing such taste?

2. Is the smell of any object really infinitesimally small particles of said object floating in the air? Are the different odors the result of the difference in the rate of vibration of these particles comprising the "odor" as stated above? Compare the smell of ammonia and that of a rose. Are there odors which we cannot perceive, due to the rapidity of slowness of vibration of the component atoms of a substance having such an odor, in the same sense that we cannot hear overtones or undertones in music?

3. Do the particles composing the hand vibrate at a much higher rate than usual when exposed to heat, thus causing the hand to vibrate at the same rate as the said source of heat, after contact with the hand? Is a "fever" the particles of the body vibrating at a higher rate than usual; and inversely, "chills," a slower rate? Are there overtones of heat and cold such as when the feet become numb? Are the atoms of the feet vibrating at such a low rate of speed that the brain cannot perceive the vibrations, or cold?

4. Is it possible that there exists matter in a concrete form, but vibrating at such a high rate as to be imperceptible to the human eye? What about radium, ether or interspace? Does the intensity of light depend upon the rate of vibration of, or upon the volume of, electrons given off at the source of light? Or is the intensity of vibration of all light the same, with some other factor determining the intensity of the light, eliminating the distance. Must all light vibrate in order to be visible to the eye? Are light and heat the same, namely vibration? Is light only a higher rate of vibration of electrons than heat, and is cold a slower rate of vibration than heat? Has there been discovered a way to accelerate the vibrations of an object? I am not considering that of heating an object, to increase the vibrations, if such is possible.

L. J. C.,
Pittsburgh, Pa.

1. The senses of taste and smell are not perceptions of vibration of the substance. If that were the case, it would be possible to stimulate the nerve-endings of the tongue and nose and produce odors. It is quite likely that some time in the future a method will be discovered whereby certain electrical changes will result because of the odor given out by the substance, but the manner in which this will be done is not through the reception or perception of vibration. A small quantity of musk placed in one corner of the room may soon be noted in any other part of the room, the odor having been wafted around is due to the presence of infinitesimal particles of the musk that were given off and float easily in the air.

2. The smell of objects, as stated before, is due to the presence of infinitesimal particles of that object floating in the air, and if there is any difference in vibration, the difference is not on the part of the particle of the substance, but on the nerve whose endings, passing through the cribiform plate of the ethmoid, imbed themselves in the mucous membrane lining the nose. We do not believe that odors are due to the rapidity or slowness of vibration of component molecules of ions of substances having such an odor, but due to the combination or compound formed. Nevertheless, we can duplicate natural odors to the extent at least of fooling our olfactory nerves, by mixing various coal tar products.

3. What the effect of the nerves of the fingers is, is likewise not known, and whether the nerve impulse propagation is due to an electrical stimulus, or to chemical or transitional changes, has not yet been determined. Articles have appeared in scientific journals in which the touch, taste, smell, and sight and the electrical theory of nerve impulse transmission were discussed. In each touch-spot on the skin is found a net-work of nerve endings, terminating in what the anatomist calls a "touch corpuscle." Stimulation of these touch corpuscles announces the fact to the brain. There are certain touch-spots for heat, others for cold, just the same as there are taste buds on the tongue in different regions for the different tastes, bitter, sweet, sour and salt, and combinations of these together with the olfactory perception of the odor, gives the epicure his remarkable ability of smelling and tasting. The particles of the body do not vibrate in fevers, or chills, the fact being pure physiological, and the result of destruction by disease germs. It is a known fact that nerves do not respond as well when under the influence of cold. Consequently, freezing definite areas enables painless operations to be conducted. This upsets your theory on the atoms of the feet vibrating at a lower rate of speed.

4. There are many vibrations that are imperceptible to the human eye. The vibrations in the ether of light or electricity are entirely too rapid; sound waves cannot be seen, although they may be perceived by the auditory nerves, when the sound waves come within the range of audibility. For the hu-

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The SCIENCE FICTION LEAGUE

A department conducted for members of the international SCIENCE FICTION LEAGUE in the interest of science fiction and its promotion. We urge members to contribute any items of interest that they believe will be of value to the organization.

●

EXECUTIVE DIRECTORS

●

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LETTERS to the editor are always welcome—and interesting. Often points are brought up that prove helpful and which serve to cement the relationship between reader and editor. But here's a typical excerpt from one of the recent letters to reach us that couldn't be dismissed with publication in THE READER SPEAKS:

Why doesn't THRILLING WONDER STORIES put out a quarterly? Certainly there are enough supporters of science fiction to warrant it. I feel there is a definite need for it. . . .

Well, frankly, we would like to give you a companion magazine. All too often we have received masterful novels written by headline authors. Lack of space and an established policy of using only complete stories have prevented us from giving them to you.

We do not believe in creating artificial suspense by continuing stories from month to month.

YOU CAN HELP

Certainly we'd like to give you a full-length novel concerning the adventures of Penton and Blake by John W. Campbell Jr.! Certainly, we'd like to publish a new, long story by Dr. David H. Keller! Of course we'd like to give you a new complete book-length novel by John Taine!

And there are many other great stories by science fiction's most outstanding writers that we have in mind.

The obvious solution is a large-sized companion magazine to THRILLING WONDER STORIES.

This idea has intrigued us for many months. But, as you know, science fiction is a highly specialized field. To make such a project possible we must depend upon the solid support of our followers.

It is up to all of us to convince the publishers of the feasibility of this idea. And we need your help!

KEEP US POSTED

Write us immediately, letting the editors know how you feel on the subject. What type of material would you like to see used in a companion magazine to T.W.S.? What authors would you want us to secure? Which size would be more popular, the large variety, like our COLLEGE HUMOR—or would you prefer a thicker edition of T.W.S.? What kind of departments and features would interest you?

The publishers have promised us that if enough followers of THRILLING WONDER STORIES indicated

their willingness to support a companion magazine they would cooperate with us.

Simply drop us a postcard saying "I want a new scientifiction magazine."

We will repay the loyalty of THRILLING WONDER STORIES' circle of followers by making it our job to provide them with a companion magazine featuring the greatest science fiction authors with their most entertaining stories.

May we hear from you soon?

SCIENTIFICONTEST

Readers, have you an unusual scientific hobby? Do you have a home chemical lab? Do you make space ship models? Do you prepare microscope slides? Are you interested in celestial photography? Are you an amateur astronomer? Do you collect fossils? Do you mount insect specimens? Do you collect meteorites?

Whatever your hobby we are certain that you'd like to tell your fellow readers about it. Here's your chance!

The editors of THRILLING WONDER STORIES will award original cover illustrations by Artist Brown to the writers of the most interesting letters on the subject of "MY SCIENTIFIC HOBBY." Prize-winning letters will be published in the next issue of this magazine. Letters may be typewritten or written neatly by hand. They should not be less than 1,000 words, nor longer than 1,500. Address SCIENTIFIC CONTEST EDITOR, THRILLING WONDER STORIES, 22 W. 48th St., N.Y.C., N.Y. Don't miss this opportunity to win a large-size authentic original cover illustration by science fiction's leading artist.

JOIN THE LEAGUE

Have you joined the SCIENCE FICTION LEAGUE? It's a world organization devoted principally to the promotion of science and science fiction—and it fosters that intangible bond which exists between all science fiction readers. Just fill out the application blank!

There are members and chapters in every part of the globe—there are interesting get-togethers, and members have worthwhile correspondences with one another.

To obtain a certificate of membership, tear off the name-strip on the cover of this magazine, so that the date and title of the magazine show, and send it to SCIENCE FICTION LEAGUE, enclosing a stamped, self-addressed envelope. We will forward you, in addition to the certificate, further information concerning LEAGUE activities.

Everybody—please write the editor of THRILLING WONDER STORIES a letter every month. We will publish as many as space can allow. We want all your opinions, suggestions and criticisms! They are helping to make THRILLING WONDER STORIES *your magazine*, the kind of a magazine *you* want.

MOST POPULAR STORY OF THE MONTH

HERE, in each issue to come, we shall announce the title of the most popular story in the preceding issue. Novelette, short story, or short short—no matter what it is, your comments will decide.

December's favorite story, based on an analysis of all letters to the editor, was:

BEYOND THAT CURTAIN
A short story by
ROBERT MOORE WILLIAMS

Which do you consider the best science fiction story in this issue?

CHAPTER NEWS AND GENERAL ACTIVITIES

LOS ANGELES

The Los Angeles Chapter of the SCIENCE FICTION LEAGUE has just released the first issue of its new monthly fan-publication, IMAGINATION. IMAGINATION is a monthly publication, selling to non-members of the L. A. Chapter at 10c a copy. It is edited by Bruce Yerke, at 660 N. Mariposa Ave., Los Angeles, Calif. Among the associate editors are F. J. Ackerman and Morojo.

The first issue, which we have seen, carries interesting personality sketches of prominent science fiction writers, science fiction news, scientifilm and scientibook reviews, poetry, humorous articles, and many other features of interest to the science fiction follower. Contributors to the journal are: Russ Hodgkins, the Chapter Director, Herbert Haussler, Ted Berk, Ethel C. Poppe, and others.

CLEVELAND CHAPTER

J. Chapman Miske and Eugene A. Singer, both of Cleveland, Ohio, together with A. Eldore Kawentel, have organized a Chapter of the SCIENCE FICTION LEAGUE. Members of the SFL and readers residing in the vicinity are urged to get in touch with Mr. Miske

for information concerning meetings. Mr. Miske's address is 5090 Train Avenue, Cleveland, Ohio.

LEEDS CHAPTER, ENGLAND

J. Michel Rosenblum, secretary of the Leeds Science Fiction League, England, writes that his chapter would be very interested t hear from any other British SFL members, and also from any members in South Africa, Australia, New Zealand, etc. The minutes of the most recent meeting read as follows:

On Sunday, Sept. 5, 1937, the Leeds (England) Chapter of the SFL held the first of its Winter Session meetings. Among those present was the director, Harold Gottliffe, the secretary, J. M. Rosenblum, the treasurer, B. H. Cohen, and many other members. By special invitation members of the Leeds Rocket Society attended, as their Technical Advis r, J. H. Gilmour, B.Sc., gave a short talk later in the evening.

The proceedings opened with a short speech by the Chairman, A. C. Sn wden, who outlined, for the benefit of the new members, the history of the Chapter. When he mentioned the resignation of the first Director, he was unable to proceed for some minutes because of the cheering. He said: "You will remember also—those of you who were present—how at our meeting of January 24th a majority of the members present decided to dissolve the chapter, and how only the prompt action of Michel in reorganizing the remaining members present saved the first English Chapter of the SFL from complete extinction. We cannot thank him too much for the services he has rendered in the past."

When Mr. Snowden had finished, the stand was taken by the Director, who detailed how he had visited the Manchester Interplane ary Society, and attended their annual meeting. He concluded: "Of course, Eric Burgess is their leading light, but he only serves to il-

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APPLICATION FOR MEMBERSHIP
SCIENCE FICTION LEAGUE

Science Fiction League,
22 W. 48th St., New York, N. Y.

I wi h to apply for membership in the SCIENCE FICTION LEAGUE. I pledge myself to abide by all rules and regulations.

Name .....
(Print Legibly)

Address .....

City .....

State ..... Age....

Occupation ..... Hobby.....

I am enclosing a stamped, self-addressed envelope and the name-strip from the cover of this magazine (tear off name-strip so that the name THRILLING WONDER STORIES and the date can be seen). You will send me my membership certificate and a list of rules promptly.
2-38

(Concluded from Page 117)

luminate the path for the others. Among the latter is J. Broadbent—who wants to use cordite as a fuel. In connection with the latter, I would remark he has invited me to attend his next experiments. I declined. Another, Bill Heeley, made one of his first rockets with an aluminum casing; its premature explosion was rather a surprise, though. Mr. Osbourne, a cinema operator, was not so lucky."

Mr. James Henry Gilmour, B.Sc., then gave a short talk on the practical applications of modern chemical research; he gave a short outline of the history of synthetic vitamins and many other interesting substances. The meeting then adjourned for tea.

The remainder of the evening was devoted to the discussion of science fiction. After the last three months' issues of the various magazines had been disposed of—including the new "Tales of Wonder," first English s-f magazine, the meeting started on books. First, the Weinbaum Memorial volume, then Olaf Stapledon's new book, "Star Maker."

An interview with Stapleton, from the latest fan magazine, "SCIENTIFICTION," was read. Among other books discussed were "Sugar from the Air," "The Machine Stops," "Star-Begotten," "The Space Raiders," "War with the Newts" and "Even a Worm."

To conclude the meeting, E. Rose appealed to the members to support the two latest English s-f publications, "SCIENTIFICTION," a first-rate printed fan mag (obtainable from W. H. Gillings, 15 Shore Roa , Ilford, Essex), and "TALES OF WONDER," a science fiction magazine with stories by Fearn, Pragnell, Beynon, Russell, and many others.

All communications to the Secretary of the Leeds Chapter should be addressed to J. Michel Rosenblum, 4 Grange Terrace, Chapeltown, Leeds 7, England.

NOTICE

THR LLING WONDER STORIES will be glad to review the various editions of the active science fiction fan magazines in forthcoming issues. All magazines should be sent to the SCIENCE FICTION LEAGUE.

NEW MEMBERS
UNITED STATES

Dr. Samuel Gottfried, 719 K Street, Sacramento, California; Gene Nangle, 302 Ga field Avenue, Bartonville, Illinois; John M. Fleig, 104 Randall Avenue, Elmont, Long Island, New York; Fre Kaufman, 41-48 40th Street, Long Island, New York; Alson C. Schoff, Derby Line, Vermont; Efton Stetler, 710 S. 8th Street, Kingfisher, Oklahoma; James F. Wray, Div. 2, 4 SS Memphis, San Diego, California; Leonard Wachsberger, 400 East 49th Street, New York City, New York; Robert Cochran, 1453 26th Avenue, San Francisco, California; Abe Raich, 613 East 3rd Street, Poeblo, Colorado; Don Wells, 3206 No. 7, Tacoma, Washington; Julian Camp, 13726 Eaglesmere Street, Cleveland, Ohio; C. L. Lat haw, 511 South Figueroa Street, Los Angeles, California; Carlton Sumsion, 1271 East 27th South Street, Salt Lake City, Utah; Eugene Mandelkan, 1042 Lenox Road, Brooklyn, New York; Ray Bradbury, 1619 S. St. Andrews Place, Los Angeles, California; Richard Wilson, Jr., 86-10 117th Street, Richmond Hill, New York.

Bert Cushway, 9729 S. Hoyne Avenue, Chicago, Illinois; R. A. Gove, 145 Highland Avenue, Ludlow, Massachusetts; Billy Rose, 1133 S. W. 23rd Avenue, Miami, Florida; Jim Hildebrand, 2603 W. Mitchell, Milwaukee, Wisconsin; Harold R. Moore, 212 Lakeshore Terrace, Los Angeles, California; Francis Watyka, Co. 1397 C. C. C., Johnstown, Pennsylvania; B. L. Hine, 8 Lansdowne Rd., Chesham, Bucks, England; William J. Noble, 301 Cedarhurst Street, Pittsburgh, Pennsylvania; Donn Brazier, 3031 N. 36th Street, Milwaukee, Wisconsin; John Clewis, 1333 West Jackson Blvd., Chicago, Illinois; Melvin Kaye, 29 Ball Terrace, Maplewood, New Jersey; Herbert S. Mednick, 5442 Montgomery Avenue, Philadelphia, Pennsylvania; Donald M. Price, 2912 Clifton Avenue, Baltimore, Maryland; Stanley R. Gau, 1548 Seymour Avenue, Utica, New York.

Harry Kreizwald, 3242 West 112th Street, Cleveland, Ohio; Thomas Hall, 2316 Vine Street, Cincinnati, Ohio; Herbert Bernstein, 686 West 204th Street, New York City; Roy Giles, 80-86 33rd Street, Astoria, Long Island, New York; Wm. Crofutt, Lealyn, Pennsylvania, R. F. D. No. 1; Bernard R. Remington, 1918 6th Street, Ocean Park, California; Stanley H. Neill, Corning, Iowa, Route No. 1; L. S. Hemen, Box 1035, Fairbanks, Alaska; Albert Villastrigo, 644 Pruitt Avenue, San Antonio, Texas; John Van Rooyan, Waldo Hotel, Columbus, Ohio; John Eckhardt, 2113 W. Cherry, Milwaukee, Wisconsin.

Hobart Drum, P. O. Box 127, Adelphi, Ohio; Edward F. Delarias, Istra ma, Louisiana; Bob Ketner, 2817 Kearney, Denver, Colorado; Vincent D'Astoly, 404 West 56th Street, New York City, New York; Roland J. Mattison, 527 W. 28th Place, Chicago, Illinois; Frank Rice, General Delivery, Marquette, Michigan; Arthur Drake, Gordon State Nursery, Gordon, Wisconsin; Herbert Giles, 2815 Pine Grove Avenue, Chicago, Illinois; Philip Yount, 2919 McPherson, Indianapolis, Indiana; J. C. Miske, 5009 Train Avenue, Cleveland, Ohio; George Tullis, 314 S. Burlington, Los Angeles, California; Bob Dougherty, 2230 Bryant St., Apartment 28, San Francisco, California; John M. Hollands, 1101 Ellicott Street, Buffalo, New York; A. Kawentel, 2209 West 53rd Street, Cleveland, Ohio; Arthur Ernst, 118 S. 12th Street, Philadelphia, Pennsylvania; Richard Bish, 109 Westminster Avenue, Hanover, Pennsylvania; Robert Siebel, 1839 Lincoln Avenue, Norwood, Ohio; William F. Adams, 2926 Garfield, Louisville, Kentucky.

Harry A. Tiley, 3554 E. 7th St eet, Los Angeles, California; Charles Lomonaco, 2276 W. R Street, Brooklyn, New York; Dana J. Coe, 915 Far Hills Avenue, Dayton, O io; Frank Bryan, Jr., Hilton Hotel, Abilene, Texas; Mark Reinsberg, 430 Surf Street, Chicago, Illinois; Bill Walter, 614 Garrison Street, Fremont, Ohio; Pvt. Roland Booker, Det. Q. M. Corps, Chilkoot Barracks, Alaska; Al Sohl, 681 East 219th Street, New York City, New York; Bob Hedgecocke, Box No. 494, Peacock, Texas; William Wallis, 801 Jones Avenue, North Braddock, Pennsylvania; Herbert P. Cummings, 7015 Corbitt Avenue, University City, Missouri.

NEW MEMBERS
FOREIGN

Renato S. Castillo, Bacolod, Negros, Occidental, Philippine Islands; A. H. Blissett, 179 Cheveral Avenue, Radford, Coventry, Warwickshire, England; Robert Cudden, 167 Parry Street, Hamilton, Newcastle, N. S. W.; Basil A. Scarff, 42 Queen's Park Road, Brighton 7, Sussex, England; Roy Bayes, R. R. No. 5, Simcoe, Ontario, Canada; Lawrence L. Harris, 47, High Street, Newport Pagnell, Bletchley, Bucks, England; Alan P. Roberts, 3 Dover Flats, Ford Street, Albion, Brisbane, Queensland, Australia; Wilson Rancome, 549 Dundas Street, Woodstock, Ontario, Canada.

A. Kidd, 134 Carmuirs Avenue, Camelon, Talkirk, Sterlingshire, Scotland; John James Mills, 4 Stants Terrace, Shrewsbury, Shropshire, England; Eric Stanyer Needham, 3 Newthorpe Street, Moorhey, Manchester, Lanca, England; Thomas Davies, 3066 Delisle Street, Montreal, P. Q., Canada; Brian Noon, 26 Heather Dene, Bromborough, Cheshire, England; M. Alexander, 92 Brooke Road, Stake Newington, London, N. 16, England; Sam Palef, 436 Preston Street, Ottawa, Ont., Canada; R. J. West, Cinema Tea Rooms, High Ro d, Laindon, Essex, England; James Jardine, Jr., P. O. Picture, Butte, Alberta, Canada; Victor Wilcock, 82 Swanage Waye, Brookside Road, Hayes, Middlesex, England; H. J. Blakeley, 97 Canning Road, Wealdstone, Harrow, Middlesex, England; G. T. Ackroyd, 17 New North Road, Exeter, Devon, England; D. G. Turnhill, 91 A Oriole Parkway, Toronto, Ontario, Canada.

FORECAST for the NEXT ISSUE

ANTHONY QUADE, special effects photography man for Nine Planets Films, Inc., was handed a tough assignment when his employers wanted him to shoot a super-special, *Space Bandit*. The story of how Quade uses his knowledge of science results in a brand-new kind of science-fiction —the story of filmland's movie capital of the future. HOLLYWOOD ON THE MOON, a novelette by HENRY KUTTNER, appears complete in our next issue.

* * *

Kerry Lundoon stared outside the ports of his space ship, the Phantom Queen. *A pile of one-inch cubes, little diamond blocks, had fallen at random on the deck. They had piled themselves into a grotesque mockery of the human form.*

It looked like something a child might have built, with a million nursery blocks. It towered twenty feet tall and was weirdly terrible. Suddenly a fantastic arm of cubes came up, made a gesture. The thing was alive!

That's only one of the dramatic situations from THE INFINITE ENEMY, a novelette of a lost Universe, by JACK WILLIAMSON, also appearing in our next issue.

* * *

Also in the next issue will be THE DARK AGE, a story of civilization's collapse. It's a thrilling story of Earth's last surviving scientists and is written by one of science fiction's old favorites, CLARK ASHTON SMITH.

* * *

Astronomers can foretell eclipses thousands of years hence, or calculate those which happened eons ago. In next month's issue of THRILLING WONDER STORIES one of England's greatest astronomers, SIR ARTHUR S. EDDINGTON, Plumian Professor of Astronomy at Cambridge University, discusses the most majestic of cosmic phenomena—eclipses—in a profusely illustrated special article, ECLIPSES OF THE SUN.

* * *

In addition to all these stories and articles, next month's i sue of THRILLING WONDER STORIES brings you more novelettes and short stories by science fiction's most popular authors. Also, our usual features, plus *two* ages of IF!

IN this department we shall publish your opinions every month. After all, this is YOUR magazine, and it is edited for YOU. If a story in THRILLING WONDER STORIES fails to click with you, it is up to you to let us know about it. We welcome your letters whether they are complimentary or critical—or contain good old-fashioned brickbats! Write regularly! As many of your letters as possible will be printed below. We cannot undertake to enter into private correspondence.

REVIEWING THE YEAR

By Julius Schwartz

Just after you purchased Wonder Stories a group of science fiction-minded friends and myself considered what possible changes this transaction would bring to the magazine. Discussion centered on the stories, authors, and make-up. One of us had the bright idea of observing just what sort of science fiction experts we were by suggesting we list our predictions and place them in an envelope marked, "Not to be opened until September 30, 1937"—thus allowing a full year and a half for our prophecies to materialize.

Today is the day of reckoning, and though my aforementioned friends were not present for the ceremony, I have slit open he envelope and reread our predictions.

Time, space, and embarrassment prevent my lis ing he complete contents, but in justice to you and the magazine I would like to mention and comment on a few of our errors.

First, it was our belief that you would ignore many of the regular science fiction favorites of several years standing and, instead, open your pages to regular pulp hack writers with any sort of fantastic thrillers. Not only were we totally wrong on this count, but you went us one better! Not only did you retain and feature such established writers as Eando Binder, John W. Campbell, Jr., Raymond Z. Gallun, John Russell Fearn, Edmond Hamilton, Donald Wandrei, Frank B. Long, Jr., J. Harvey Haggard, Ralph Milne Farley, but you brought back several who had been missing for several years: Otis Adelbert Kline, A. Merritt, Paul Ernst, Arthur L. Zagat, Ray Cummings, Arthur K. Barnes and Arthur J. Burks.

We further believed that in the time limit set you would have printed a maximum of five superior stories. (Our term "superior" is somewhat like the term "classic" used by the science fiction fan. We don't go quite as far, merely calling a story superior if it is one worth rereading, and one which certainly would be included in a list of Best Stories of the Year.) T.W. . ahowed us up again by printing at least ten superior stories.

Heading the list, in my opinion, is Stanley G. Weinbaum's posthumous tale, "The Circle of Zero." I happen to know that this one was one of Weinbaum's personal favorites, and it is regre table that Weinbaum never lived to see the story in print. Another of the best ten, but further down the list, is Weinbaum's "Brink of Infinity." Many readers no doubt will object to this choice, but for a story with sustained interest this one tops them all.

Vastly different from anything he had previously written, John W. Campbell, Jr., must have amazed his many followers with his excellent, "Brain Stealers of Mars," possibly Campbell's best work to date. Ralph Milne Farley surprised quite a few of us with "Liquid Life," his timely filterable virus story.

To Eando Binder go two places on this coveted list. "Chessboard of Mars" was far and away the best he has ever done, while following closely behind was "Conquest of Life."

A. Merritt's "Rhythm of the Spheres" was a beautiful piece of writing, and is possibly the story that will be remembered long after the others have been forgotten. Anthony Rud gave us something to re e - ber with "The Molten Bulle ," an ordinary plot distinguished by excellent writing. Arthur Leo Zagat can always be depended upon to turn out something interesting, but he outdid himself in "The Lanson Screen." Concluding the list is "Hothouse Planet," by Arthur K. Barnes, a tale that Weinbaum might have believed he had written!

Illustrations, it was our opinion, would definitely decline. Wrong again! The acquisition of Wesso and Marchioni for the interior work, and Brown for the covers, has given T.W.S. art-work and general make-up second to none. Jack Binder's IF is good. And so is the department, SCIENTIFACTS.

That covers the "predictions" of immediate interest to you. You have done a mighty good job so far.—255 E. 188th St., New York City, N. Y.

ZARNAK MISSING!

By James V. Taurasi

Have just finished reading your December issue of THRILLING WONDER

STORIES. I think that this was the best issue you have yet put out. The best liked feature in this issue was: "Eight Days in the Story of Rocketry," by Willy Ley. I'm glad to see that we will have more science features in future issues. The best story this month was "The Tenth World," by Campbell, with "Red Shards on Ceres" in second place.

I like the dea of the author's picture being used with his article, as in the case of Willy Ley. I hope to see other authors in the future likewise represented.

I notice that with this issue you have dropped ZARNAK. I did not like the story at all, but I don't think it was r ght to terminate the continuity so abruptly. What happened to ZARNAK?—137-07 32 Avenue, Flushing, New York.

(The editors are as puzzled as Mr. Taurasi regarding the disappearance of ZARNAK, our favorite science fiction character. When the December issue of T.W.S. came back from the printer we discovered that ZARNAK was missing. The printer did not know what had happened to him. Neither did we. Perhaps some of our readers can offer suggestions. —Ed.)

LIKES THE STORIES—BUT NOT THE LETTERS

By D. C. Moore

I have been an ardent reader of science fiction for the last three years and to my mind there is no finer type of fiction for one to read. On turning to the readers' letters, however, I find that most of them do not show their writers as being particularly intelligent It is obvious that they prefer the "flashy" type of yarn full of spectacular feats, not caring whether these feats are probable or even slightly possible; they ask for no explanation as to whether a certain thing on which the story is based is feasible but rush through the stories in a short space of time and go on to something else.

Another complaint about readers' letters is the number which harp on the subject of the cover illustration. What does it matter to an intelligent reader whether the cover is good or bad? My opinion is for readers to spend their time making useful criticisms on their stories and less on the cover.

May I take this opportunity of inviting readers to correspond with me on scientific subjects? All letters will be answered—11, Grenada Rd., Charlton, S.E. 7, London, England.

SCIENTIFIC ACTIVITY WANTED

By Casimir Pierog

In my estimation, the December T.W.S. shows a marked mprovement over all other issues. "A Month A Minute" topped the list with me; please tell Mr. Farley to think up some more yarns. This one, besides being highly intriguing, showed marked originality, which is a very rare quality. Congratulations, Mr. Farley!

"Beyond That Curtain" by Robert Moore Williams and "When Space Burst" by Ed-

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(Continued from Page 121)

mond Hamilton rang second bell with me, the first because of its unbearable suspense, and the second because of its vivid description of hyperspace.

I am heartily in approval of Alfred Brown's proposal. Incidentally, Ed., if you install a column of scientific debate in T.W.S. you will direct some readers from your person to their discussions—and that's one way to live longer!

Seriously, though, I think such a department would be a big success. Only please do not print any of that stuff which can be answered by looking into any high school text books.

I have an idea of my own. So far, SFL development has been confined to literary lines. Why not start a drive for the installment of scientific departments in the various Chapters? For instance, members whose hobby is radio would build a club "ham" station, and have an electrical workshop. Members interested in chemistry would install a research laboratory, etc. Who knows, maybe some reader would make a valuable scientific discovery, and put T.W.S. in the limelight?

Departments of various chapters would cooperate with each other, and the resulting discussions and debates would be printed in the department suggested by Mr. Brown. It is my opinion that such a step would be a real advancement toward the science predicted in your stor es. Let's be scientists, not dreamers!—7605 Osage Ave., Cleveland, Ohio.

PENTON AND BLAKE NOVEL?

By John Chapman

The December T.W.S. was no mprovement over the October one, but nevertheless it was good. Had ZARNAK still been a big black spot among the pages, I would hesitate at giving it an average rat ng. But now our hero is but a myth. (He always was.) What happened to him, anyway? Did his super-electric ray gun run short of B.B. pellets, or did this big thing that last had hold of him around the neck turn out to be a science fiction fan?

"The Tenth World" was excellent. When I finished "The Immortality Seekers" two months ago I was in doubt as to whether Campbell could do any better. But he did, and "Tenth World" goes down as the best story in the December issue. How about a full-length novel concerning the exploits of Penton and Blake?

"Beyond That Curtain" was by far the best short story. That type of story always makes interesting reading.

A few requests. When do we get our monthly, or don't we? And most of all, how about some novels once in a while?—1521 Como Ave., S.E., M nneapolis, Minn.

ROCKET POWER

By Philip Lee

Your December issue is one of those rare phenomena of science fiction, a copy whose

worst stories are not punk, and whose best are something remarkable. Deletion of ZARNAK will be appreciated by all, I'm sure. Ley's article was, of course, interesting, and Campbell, Jr., was up to his usual form. But "Beyond That Curtain," by R. M. Williams, was a bell-ringer, and deserves unstinted praise.

That scheme suggested by C. Battell Loomis for a sun-powdered space craft seemed good, but you rather flattened it in your remarks. But it was, after all, a thermal rocket, and so liable to the particular fault of such—I mean the rocket gases must leave the nozzle at a comparatively low speed, because the rocket, any rocket, wouldn't stand up at 5000 degrees C. A solution to this problem is apparent upon reading a science article in the September issue of Harper's Magazine.

A "proton-gun," which works on a static charge, is there described. Its missiles have a muzzle velocity of 19,300 miles per second. If your ship weighed two tons, the reaction of 2 pounds of protons at that speed would give a velocity of over 7 miles per second. Now the idea is to have a large mirror of very thin sheet aluminum focused on a steam turbine, to drive an electrostatic generator capable of an output of 5,000,000 volts (the required voltage), this current to be fed into a "proton-gun" which, suitably refined and lightened, would function as a rocket. If all the parts were efficient enough, (a metal-foil mirror, mercury-vapor turbine, etc.) the ship might rise into the air. If so, it could rise an indefinite distance, because its power is unlimited, and its operation doesn't depend on an atmosphere.

At the end of Mr. Loomis' letter, you say —"Speeds and acceleration . . . depend entirely on how much fuel you can carry." This ship could carry enough fuel to reach escape velocity a hundred times, and so we could squander it in slow starts suited to its power intake.—Gallen, Michigan.

FROM COVER TO COVER

By T. Bruce Yerke

The December issue of THRILLING WONDER STORIES definitely proves to all fans that T.W.S. is a genuine, first-rate, science fiction magazine. You are well in your second year, and the veteran fans have come to accept you as a fitting replacement to the old Wonder Stories. I have little doubt that your magazine has helped to interest many new readers in science fiction because of your policy of "light science stories."

The Dec. cover impressed me quite favorably, and I consider it one of the best of the year. It had a distinctive tinge of science fiction about it.

The general standard of Messrs. Penton and Blake improved vastly in "The Tenth World." The last story was slightly haywire in my opinion, but this time I really enjoyed the lads. The theme of the "1,000,-

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000 year-olds" lack of control over their bodies was intriguing, though it seemed to me impracticable.

SCIENTIFACTS was o.k. I was glad to see that it was longer. "Eight Days in the Story of Rocketry" was good; it will interest readers scientifically inclined.

"Beyond That Curtain" fitted into the magazine just right; short, interesting. The author kept the right amount of interest and mystery throughout. It was the best short in the issue. "The Mind Magnet" was a good scientific-adventure yarn presented entertainingly. Gallun's "Red Shards of Ceres" was a good yarn, being well written, and bringing in some nice human interest touches.

Last but not least we come to "The Bloodless Peril," which was a pretty different type of story, with human-interest, science and action well proportioned—and nothing overdone.—660 N. Mariposa Ave., Los Angeles, Calif.

FAREWELL TO ZARNAK

By Richard Wilson, Jr.

The December issue is by far the best of the new WONDERS. Even if the stories were unrelievedly hack (which they weren't, really); even if you had Marchioni illustrate the whole magazine—please don't do that, ever; and even if you had omitted THE READER SPEAKS entirely (horrible thought); it would still be the best issue I've ever seen, mainly because you've finally seen the light and sent Poppa Plaisted a rejection slip and told him what he could do with ZARNAK. In the October issue, however, when a pair of hands had Our Hero by the throat (lovely ands, really) causing him to say "Ugh-h-h-h!" in a despairing sort of voice, the caption, instead of reading "Next issue—'Farewell to Mercury'," should have said "Farewell to Zarnak." This would have given your readers two whole months of happy anticipation. Don't think that I'm being unappreciative, though. I'm not. When this issue appeared, Zarnakless, I tore down to the little candy shop that serves our quaint village and immediately bought another. The fact that I wanted one for my collection, and one to use for SCIENCE FICTION LEAGUE membership, is, of course, only incidental.

Jack Binder's IF gets better and better. I thoroughly enjoy your series of fact articles by prominent authorities in various fields of science. Willy Ley's, this month, was no exception. I'm glad you included his picture.

The latest Penton and Blake adventure has it all over any other story in the book. Gallun's story is good, as is Farley's, though I didn't particularly like "When Space Burst." I always find THE STORY BEHIND THE STORY as interesting as the fiction itself.—86-10 117th Street, Richmond Hill, N. Y.

A 5-STAR INDICTMENT

By Gerry Turner

I hereby exercise my right to criticism of the December issue. And there is quite a lot to be said. 1—I notice, with a hearty sigh of possible, premature relief, the disappearance of ZARNAK from the pages of this publication. After all, isn't it a little absurd, this childish comic-strip? I would like to see an illustrated feature, similar to ZARNAK, but written intelligently. Why not reprint a Weinbaum story in picture form? Or at least get some professional author to do the honors.

2—The cover. I have rarely seen a more garish one. Make the exterior illustration dignified and interesting. I know that yellow and red attract more attention, but I'm certain that blue and purple would be more in keeping with the contents, which are not cheap in the least.

3—Paul Ernst's story, "The Mind Magnet," is a magnificent example of nothing at all. I'm personally fed up with these obviously straining efforts to be different.

4—"A Month A Minute," by Ralph Milne Farley, is rather entertaining, but there is scarcely anything to it. The entire plot can be written as follows: "Boy and girl are propelled through time by girl's grandfather, only to return after a month that was in reality of a minute's duration." In short, it lacks adventure. Rather disappointing after the author's entertaining "Liquid Life," which is the type of story I most enjoy.

5—"The Tenth World," by John W. Campbell, Jr., was fine, but it too lacked a plot. Mr. Campbell apparently wasn't interested in explaining why or how the heroes left Ganymede, except to dismiss it with the fact that they didn't want to remain to hear a speech. Now, that hardly seems much of a start. I will say, though, that Campbell can make things interesting if he isn't taken too seriously. Until the next issue, then, smooth sailing and a less gaudy cover!—Hotel Bretton Hall, New York City, N. Y.

AN AUTHOR'S COMMENTS

By Ralph Milne Farley

May I congratulate you on the departure of THRILLING WONDER STORIES from the stereotyped current ideas as to what constitutes science fiction. I will give you a few examples of what I mean. In the October issue, "The Hothouse Planet" is primarily a picture of life on Venus, rather than an action story, yet it is done with such expert delineation of details as to be more thrilling than a mere action story with a Venusian background.

With regard to "The Space-Time-Size Machine," neither you nor Ray Cummings seems to have feared the supposed editorial taboo against stories with "and-then-he-woke-up" denouement, nor the supposed editorial taboo against poking fun at sci-

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ence fiction. The result is an excellent and readable story.

Binder's "A Comet Passes" makes no pretense at being a story, and instead is an excellent series of thumb-nail sketches of the status of world civilization at the successive arrivals of Halle's Comet. The other stories are more conventional, but show originality in handling.—1265 Fairview Avenue, South Milwaukee, Wis.

FROM AN OLD-TIMER

By David A. Kyle

There have been so many new names in THE READER SPEAKS recently that I have at last thought it advisable for a fairly old-timer to tell of his reactions to this new magazine. My last letter to you was over a year ago, published in the first issue of T.W.S. As one of the first members of the SFL, secretary of Chapter Five, I feel that my opinions might prove interesting.

When I first learned of the new policy to be enacted by the editors, I was frankly skeptical that the s-f readers would ever again feel as though T.W.S. was their magazine. I watched carefully, but was, perhaps, a little prejudiced.

At last I have formed a few definite opinions. The make-up of the magazine is very well arranged. The print and format are well done, and the inside illustrators are quite competent, despite the fact that Mr. Paul no longer draws. THE READER SPEAKS does not contain enough letters. (How about this month?—Ed.) The SCIENCE FICTION LEAGUE Department, however, is excellent. By publishing the news of your chapters, you are helping science fiction to spread itself through the medium of fellowship. Fans soon will know each other and feel themselves unified for s-f advancement. THE STORY BEHIND THE STORY is an ideal thing. It helps to stimulate the reader to think out the science plot for himself. This brings us up to the content of the magazine itself, the stories.

T.W.S., as we all know, has emphasized the thrilling without the expense of the science element. I have come to the conclusion that the type of science fiction which you advocate is the type of science fiction which wil best popularize this field. What do the other readers think?—Monticello, New York.

GERRY CARLYLE VS. PENTON & BLAKE

By C. C. Wilhelm

Congratulations on a marvelous October issue, and be sure to keep Campbell coming! The Penton and Blake series is excellent. The curious "muscle-mobile" is one of the most ingenious gadgets I've ever encountered in science fiction.

But Campbell will have to beware of any slackening-up, or his crown may slip.

There's a swell new character around the bend th t has plenty of possibilities. I mean Gerry Carlyle, the female scientific Frank Buck of the future. Mr. Barnes' story was a good, strong second to Campbell's. A lot of my friends read T.W.S.—Henry Roshier, and J. J. Demaree, for example, and they too would like to see more of Barnes.

I was disappointed somewhat with the "Tubby" story. Likewise, I thought "A Comet Passes" was lacking in unity. But Giles and Kuttner were both above par. Let's have the department featuring authors' photos, biographical sketches, notes on artists, etc.—Glendale, Calif.

THE STORY BEHIND THE STORY

(Continued from Page 6)

The idea of giving Venus a moon, incidentally (to get back to the real origin) resulted from an old, old reject in the bottom of the trunk in which the dashing young hero can't make love to his true love on Venus—because there is no moon to inspire him! What is that saying about the acorn growing up into the tall oak? From moonless romances on Venus to the immortal Anton York whisking worlds around as though they were pebbles!

The rest of the story hinged around the rather delightful thought of two such long-living and learned chaps having it out with one another. Perhaps there I was thinking of my childhood fairy tales, with the gods replaced by test-tube immortals, and scientific jugglery substituting for magic—if there's any difference! Hope you like it.

STRATOCAR SERVICE

BEFORE the conquest of the void must come the conquest of the stratosphere. And, while the job of being a stratocar pilot might sound pretty glamorous to a Twentieth century adventurer, it is quite possible that for some adventurous soul of the future it would mean a rather banal existence.

MANLY WADE WELLMAN, popular author of science fiction, drapes this idea with some interesting speculative trimmings and the result is DREAM DUST FROM MARS, a top-notch scientific adventure story. He'll be ready to write more of this type—if you want him to. Here's the genesis of this one:

The idea of the stratosphere car in DREAM DUST OF MARS must occur at least once to every science fiction author and reader—the thousand-mile-an-hour craft that can circle Earth and re ain under the noonday sun all the time. But, when I thought of it, I realized it would hardly be wonder enough for THRILLING WONDER STORIES. The progression of the idea sketched in my imagination a world where the true marvels were interplanetary ships and visitors from far worlds, but where the stratocar would exist as a familiar hack service—a sort of Toonerville Trolley of rocket flying. In such a ship young men would grumble and dream of more exciting adventures between planets.

The dream-dust business developed in my mind when a pessimistic friend vowed he wished he could take a drug and sleep through

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the coming century, thereby missing a lot of grief. For a moment I was inclined to agree with him, then I wondered if the century after next might not be just as hard to face—as hard, maybe, as the last century was for our grandfathers. Other items filled themselves in. I've written about Martians like the villain of the piece before, also weapons like the rust-ray; every regular writer of science fiction has his own complex picture of the future Universe, and from it peoples and dresses his plots. As for the hero, I suppose he's universal in all adventure stories. Lots of people snicker at him, but they all wish they were like him.

BROOD OF THE INVISIBLE MOON

SCIENCE tells us that there are numerous vibrations and rays whose existence our normal senses do not detect. We cannot see, for example, below the infra-red, or above the ultra-violet. Nor can we hear sounds above or below a certain pitch.

Is it unreasonable, therefore, to assume that there is a form of matter coexistent with matter as we know it, yet not perceptible to our ordinary senses? If so, what would happen if the gateway between two worlds of different matter were unlocked? What would step across the threshold?

WE, THE INVISIBLE, a novelette by FRANK B. LONG, Jr., gives you the fascinating answer. And here's how he came to write the story:

I think I can truthfully say that WE, THE INVISIBLE wrote itself. I was in a deep, brown quandary, having reached the considered conclusion that original science fiction plots were rarer than live dinosaurs in Twentieth-century America when the theme came zooming out of the ether, and shattered my despair into glowing fragments. In casting about for an idea I had rejected one which had always fascinated me—the possibility of other worlds of matter and intelligence existing right alongside of us, but in another dimension.

I rejected the idea when sober reflection convinced me that it was as old as an Ordovician landscape. Virtually every science fiction writer from Verne to the current crop has tried his hand at it. A magnificent story could still be written around that theme, but I was reluctant to join the handwagon because I'm a solitary cuss and like privacy. But the basic conception would not down, and suddenly while I was brooding over it WE, THE INVISIBLE batched itself miraculously in the ether. Why not another world in the same dimension as our world, and yet invisible, intangible, flowing through us and not disturbing us at all?

Why not an invisible world of incredibly attenuated energies made suddenly substantial by forces beyond human control? What would happen if such a world swam suddenly into our ken from nowhere? What would happen if all over the earth alien forms of life and matter leaped into sudden, appalling visibility overnight? I tried to imagine what would happen, and then it was that invisible fingers seemed to take possession of my typewriter and the story wrote itself.

Of course, I performed the outward act of literary creation, but I have an eerie, incredible suspicion that if I had refused to cooperate WE, THE INVISIBLE would have haunted me and worn me down. But I was only too glad to help and that is how the story came to be written.

THE TIME-TRAVELER

SCIENCE fiction stories have been inspired by odd newspaper clippings, by obscure scientific items, and even by popu-

lar science articles in the national magazines. But THE CHANGER OF HISTORY, the fascinating short story by ALEXANDER SAMALMAN in this month's issue, was stimulated by some lines by a famous poet. We thought you'd like to know about it, so here goes:

The genesis of THE CHANGER OF HISTORY is difficult to explain. The subjects of time and space, and light and sound waves, have always intrigued me. However, THE CHANGER OF HISTORY did not result directly from speculation on these topics.

One evening I thumbed an anthology of poetry, and came across these lines by William Blake which I already knew—lines long engraved in my mind:

"To see a world in a grain of sand,
And a heaven in a wild flower;
Hold infinity in the palm of your hand,
And eternity in an hour."

I wish I could reconstruct the mental processes involved—but somehow the rereading of these lines brought me the idea of a light-wave machine which could bring the past and future before the eyes of the present. And I sat down and wrote THE CHANGER OF HISTORY.

Originally, I quoted the lines from Blake somewhere in the story; but on revising, I realized that they had little to do with the yarn, although they had furnished the inspiration, and I struck them out.

SCIENCE QUESTIONS AND ANSWERS

(Concluded from Page 114)

man being this range is from 16 to 40,000 vibrations per second. The intensity of light does not in any way depend upon the rate of vibration, if that light is of one color. White light, being a compound of all colors, will comprise different periods of vibration. The intensity depends more upon the volume of the source of light.

Although all matter vibrates, it is not always the vibration of the matter which enables the eye to see the substance. It may be the reflection of the light from the matter, which reacts upon the rod and cone layer of the retina of the eye. These either electrically or physiologically transmit that record to the brain where the image is reconstructed. The method of doing this has not been definitely ascertaine . Light and heat are both vibrations, but they are not the same. It is possible that one results from the other, due primarily to the speed of vibration. Unfortunately, no method has been discovered which will accelerate the vibration of the molecules of any object.—Ed.

GUIDE TO SCIENCE KNOWLEDGE ANSWERS

(See Page 63)

1—Page 74 in LIFE ETERNAL.
2—Page 43 in ZONES OF SPACE.
3—Page 46 in ZONES OF SPACE.
4—Page 59 in THE CHANGER OF HISTORY.
5— age 65 in GIANT and DWARF STARS.
6—Page 66 in GIANT and DWARF STARS.
7—Page 29 in VIA ASTEROID.

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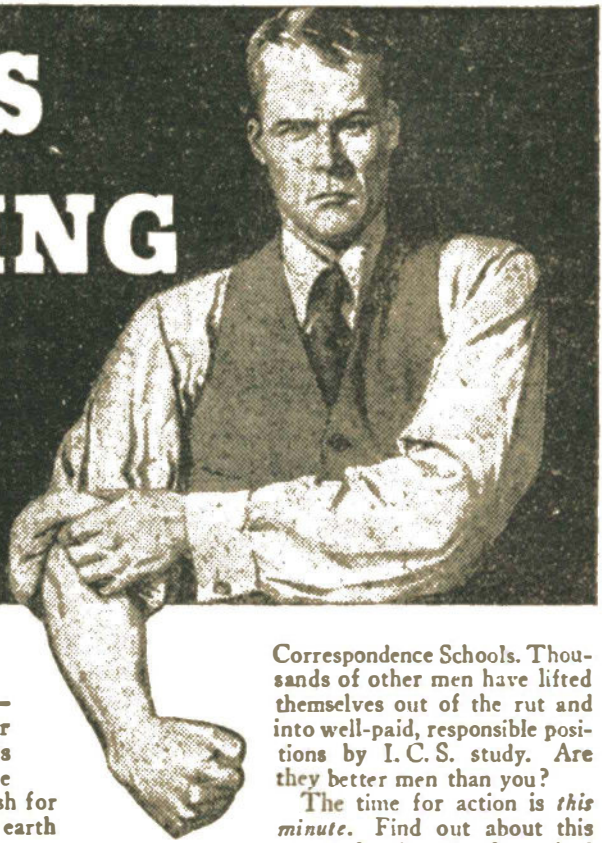

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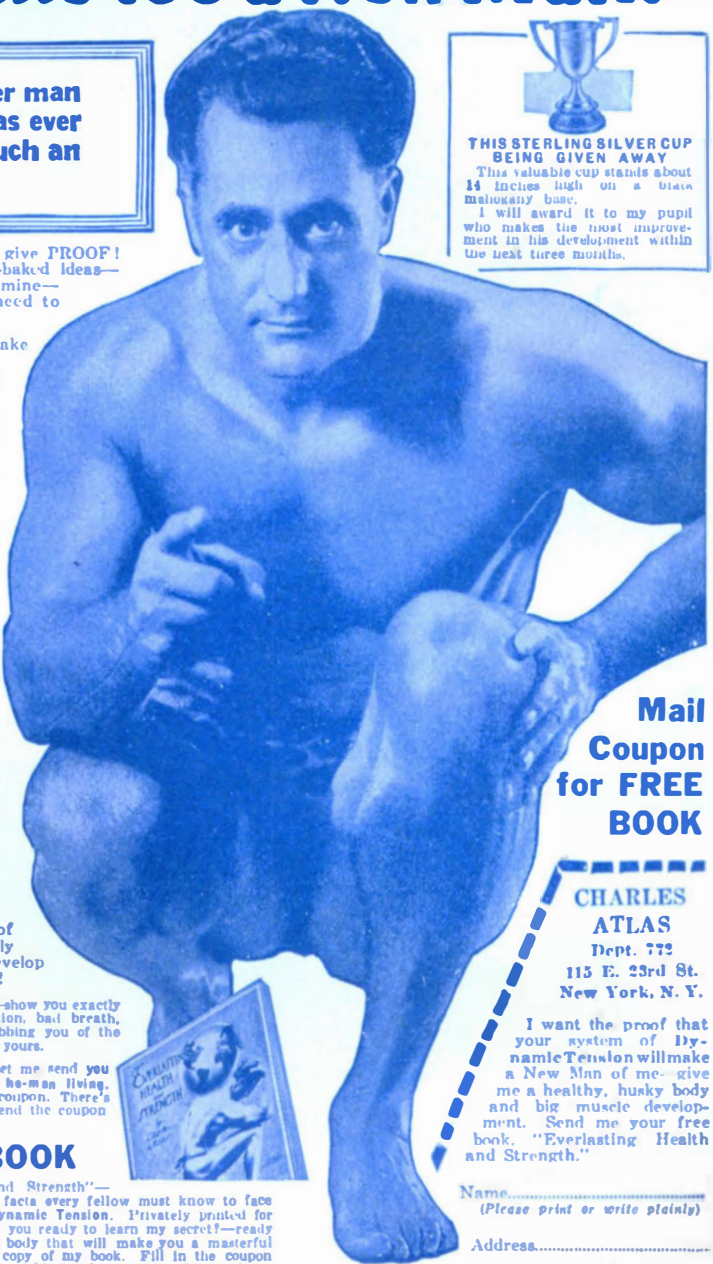

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I used to be a sickly, half-pint runt weighing only 97 lbs.—a "laughing stock" wherever I went. No fun. No friends. Right there I almost "fell" for some of these freak spring or weight contraptions to make me "strong." But THEN—by the luckiest break of my life—I discovered **Dynamic Tension.**

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