
ASTOUNDING
SCIENCE FICTION
20 CENTS
JULY 1939
A STREET & SMITH PUBLICATION
BLACK DESTROYER by A. E. Van Vogt
JULY, 1939
ASTOUNDING SCIENCE-FICTION
LESTER DEL REY
RAY CUMMINGS

LISTERINE ENDS HUSBAND'S DANDRUFF IN 3 WEEKS!

Child's case cleared up within 10 days

"Last year my husband had a bad case of dandruff. Nothing he tried seemed to do any good for it. Finally I persuaded him to try Listerine Antiseptic. At the end of three weeks his dandruff had completely disappeared. A few months ago one of the children's hair showed signs of dandruff for the first time. Listerine Antiseptic cleared that case up within ten days! Now we all take a Listerine Antiseptic treatment once or twice a month 'just in case,' and we haven't had even a suggestion of dandruff since."

MRS. ERWIN CARLSTEDT
Box 507, Boynton, Fla.

Did you think nothing short of a miracle could rid your hair of dirty, telltale dandruff flakes? Have you finally given up in disgust trying remedy after remedy?

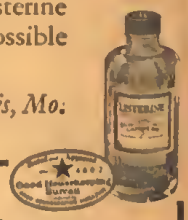
Well, here, at last, is positive hope of real relief. A method which has been *proved* in laboratory and clinic. A delightful, invigorating treatment which has brought complete, lasting relief to countless men and women—Listerine Antiseptic and massage.

The secret of the Listerine Antiseptic treatment is killing the germ. It was only recently that Scientists discovered that dandruff is a germ disease . . . caused by a queer little bottle-shaped parasite, Pityrosporum ovale! Immediately things began to happen in the medical world.

In one research, at a great mid-western skin clinic, dandruff patients were instructed to use the Listerine Antiseptic treatment once a day. Within two weeks, on an average, a substantial number obtained marked relief! In another study, 76% of the patients of a New Jersey clinic who used the Listerine Antiseptic treatment twice a day showed complete disappearance of, or marked improvement in, the symptoms within a month. Now, from all over America come letters from men and women telling us of relief they have received from Listerine Antiseptic.

Don't waste another day before starting to rid your scalp and hair of dandruff. Start at once with Listerine Antiseptic and massage. Even when dandruff has disappeared, use Listerine Antiseptic occasionally to offset possible recurrence.

LAMBERT PHARMACAL CO., *St. Louis, Mo.*



THE TREATMENT

MEN: Douse Listerine Antiseptic on the scalp *at least once a day.* **WOMEN:** Part the hair at various places, and apply Listerine Antiseptic right along the part with a medicine dropper, to avoid wetting the hair excessively.

Always follow with vigorous and persistent massage with fingers or a good hair brush. But don't expect overnight results, because germ conditions can not be cleared up that fast.

Genuine Listerine Antiseptic is guaranteed not to bleach the hair or affect texture.

LISTERINE THE *PROVED* TREATMENT FOR **DANDRUFF**

Be a Radio Expert

Many make $30 $50 $75 a week

I will train you at home for many Good Spare Time and Full Time Radio Jobs

J. E. SMITH, Pres., National Radio Institute
Established 25 years

He has directed the training of more men for the Radio Industry than anyone else.

Radio offers you many opportunities for well-paying spare time and full time jobs. And you don't have to give up your job, leave home or spend a lot of money to train to get these jobs—to become a Radio Expert.

Get Ready Now for Jobs Like These

Radio broadcasting stations employ engineers, operators, station managers and pay well for trained men. Fixing Radio sets in spare time pays many $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as $30, $50, $75 a week. Many Radio Experts open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, in good-pay jobs with opportunities for advancement. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read how they got their jobs. Mail coupon.

Why Many Radio Experts Make $30, $50, $75, a Week

Radio is young—yet it's one of our large industries. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new tubes, repairs. Over $50,000,000 are spent every year for Radio repairs alone. Over 5,000,000 auto Radios are in use; more are being sold every day, offering more profit-making opportunities for Radio experts. And RADIO IS STILL YOUNG, GROWING, expanding into new fields. The few hundred $30, $50, $75 a week jobs of 20 years ago have grown to thousands. Yes, Radio offers opportunities—now and for the future!

Many Make $5, $10, $15, a Week Extra in Spare Time While Learning

The day you enroll, in addition to our regular Course, I start sending Extra Money Job Sheets; show you how to do Radio repair jobs. Throughout your training I send plans and directions that made good spare time money—$200 to $500—for hundreds, while learning.

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I send you special Radio equipment; show you how to conduct experiments, build circuits illustrating important principles used in modern Radio receivers, broadcast stations and loud-speaker installations. This 50-50 method of training—with printed instructions and working with Radio parts and circuits—makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL ALL-WAVE, ALL-PURPOSE RADIO SET SERVICING INSTRUMENT to help you make good money fixing Radios while learning and equip you with a professional instrument for full time jobs after graduation.

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I am so sure I can train you to your satisfaction that I agree in writing to refund every penny you pay me, if you are not satisfied with my Lessons and Instruction Service when you finish. A copy of this agreement comes with my Free Book.

Find Out What Radio Offers You

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. SMITH, President
Dept. 9FD, National Radio Institute
Washington, D. C.

Broadcasting Stations

Employ managers, engineers, operators, installation and maintenance men for fascinating jobs and pay up to $5,000 a year.

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Fixing Radio sets in spare time pays many $5, $10, $15 a week extra while learning. Full time repair pays as much as $30, $50, $75 a week.

Loud Speaker Systems

Building, installing, servicing and operating public address systems is another growing field for men well trained in Radio.

HERE'S PROOF THAT MY TRAINING PAYS

$50 Monthly in Spare Time

"I work on Radio part time, still holding my regular job. Since enrolling seven years ago, I have averaged around $50 every month." JOHN B. MORISSETTE, 809 Valley St., Manchester, N. H.

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"I am making between $50 and $60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N.R.I." H. W. SPANGLER, 126½ S. Gay St., Knoxville, Tenn.

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"I have a position with the Los Angeles Civil Service, operating the Public Address System in the City Hall Council. My salary is $170 a month." B. H. ROOD, R. 136, City Hall, Los Angeles, Calif.

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National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out the spare time and full time opportunities in Radio and explains your 50-50 method of training men at home in spare time to become Radio Experts. (Please Write Plainly.)

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VOL. XXIII NO. 5

COVER BY GRAVES GLADNEY

NOVELETTES

SHORT STORIES

ARTICLES

READERS' DEPARTMENTS

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YOU young fellers are proud as Columbus, when you discover Union Leader Tobacco! You praise its fragrance. Its freedom from bite. The mellowness of its hill-grown Kentucky Burley. The economy of its big 10 cent tin . . . either in a pipe or "roll your owns."

All true! But it isn't news to an old-timer who's enjoyed Union Leader for more than 30 years. What you've really discovered is this:—There are some things—like deep-dish apple pie, steak broiled over charcoal, and a pipeful of Union Leader—that have never been topped! And I'm hopin' they never will be!

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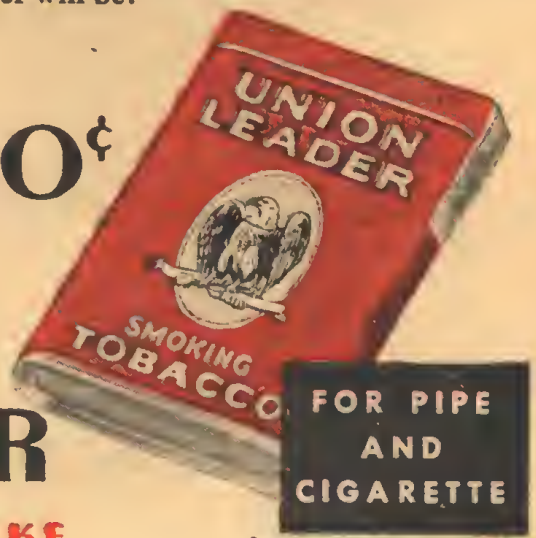


UNION LEADER

THE GREAT AMERICAN SMOKE

ADDENDA

In the latter part of January, the uranium-fission atomic reaction was first announced in this country. The importance of that discovery was immediately evident to atomic physicists, and an equally immediate, widespread investigation of it commenced. The results of that almost frantic investigation have accumulated so rapidly that the item "Jackpot" which occupied the Editor's Page in the April issue is entirely out of date.

That page ended with the question "Can we, perhaps, put a name to the discoverer of the secret of atomic power?"

It is no longer a question. Commercial atomic power is entering the technological stage at the present time. The theoretical work is rapidly approaching completion, and practical techniques will grow as progress is made.

When the first announcement of the uranium-fission reaction was made, the situation stood about thus: Fermi, several years back, had announced the synthesis of Element No. 93, and other, yet-higher elements, by neutron bombardment of uranium, Element No. 92. In January, Dr. Hahn announced that Fermi was wrong in his belief—he'd accomplished something of immense importance, but had misinterpreted the results, and explained how the error had arisen.

Fermi bombarded uranium with neutrons, hoping to increase the mass of the heaviest-known element to a heavier, unknown substance. All experiments with neutron bombardment hitherto indicated that one of three things might happen: Uranium might act like cadmium, which absorbs neutrons as a sponge soaks up water—it gets heavier, but no change of any importance takes place. It's still cadmium, still unresponsive. That seemed improbable with an element whose nucleus was already as complex as that of uranium.

Second, neutrons might simply make uranium release immediately the radioactive energy it normally released in the course of several billions of years, and give rise to radioactivity leading to radium.

The third possibility was the one Fermi was betting on; that the neutrons would enter the uranium nucleus, increase its mass, and cause a rearrangement of charges resulting in the formation of unknown, heavier elements.

These new elements, if synthesized, could not be produced by the gram, naturally, but by the atom. Chemical analysis, per se, would be helpless to detect them. Spectrum analysis would be useless, because the spectra were, naturally, unknown. But there was another, combination method that was possible.

Element 93, if formed, should be a member of the manganese group. Its chemical properties should be like those of manganese, masurium and rhenium—it should precipitate under chemical conditions that precipitated these other, known elements, and should remain in solution when they did. Therefore, one could treat the uranium, dissolve it, and precipitate the uranium, leaving in solution any new, nonuranium atoms. Then if these new ones were there, the chances were excellent they would be radioactive. Their quantity might be too slight to weigh, but not too slight to detect by radioactive methods.

By tracing the radioactivity, it was soon found that a radioactive member of the manganese group was present; it was found in the precipitate when manganese-group precipitates were tested for, and in the solution when manganese metals should be in solution.

Further, the uranium appeared to be yielding some radium by hastened, though otherwise normal, radioactive disintegration, for the calcium-group precipitates showed activity. The calcium group includes calcium, strontium, barium and radium. The prognosis of the three possibilities seemed confirmed.

Because of an almost incredible coincidence! The uranium was not building

up to Element 93. It was not even splitting to radium. It was being shattered in an unheard-of manner, a manner for which a wholly new term had to be invented—fission. But the fission was yielding two large element-atoms from uranium's single monster atom—barium and masurium. Barium and masurium—masurium of the manganese-group and barium of the calcium-radium group! And, naturally, after any such process of inconceivable violence as the fission of the uranium atom, both were radioactive, cloaked and masked to match exactly the expected products of expected reactions!

They've investigated more carefully, now they know the truth, and found that not only are barium and masurium formed, but also iodine, tellurium, xenon and caesium. But these products are unimportant. The immensely more important product of the fission is—free neutrons!

For sheer violence, the fission of the uranium atom is unmatched. The heart of a star does not equal it. The explosion of a radium atom yields an energy measured by some ten million electron-volts—the energy of an electron falling through a ten-million-volt field—as compared to the four-electron-volt energy of carbon burning to carbon dioxide, or the five-volt energy of a molecule of TNT exploding. But the uranium-fission yields two hundred million volts.

But it is not the violence of the reaction that makes it mean so much more than other types to commercial, useful possibilities. Uranium, bombarded by neutrons, yields various atoms, *plus more neutrons*. Those new, free neutrons make possible a self-perpetuating, self-maintaining reaction, one that, started by Man, would maintain itself as no other known reaction would.

But—why wasn't this spread detected heretofore? One single lump of coal will not burn alone; the heat essential to maintaining combustion is lost to the surrounding air faster than it is produced by burning. High-velocity neutrons—and those escaping from the uranium-fission have lots of velocity—are extremely penetrant. They pass through considerable masses of matter—particularly heavy atom.

Evidently a large mass of uranium must be used—and by a large mass, something of the order of a cubic foot is meant. Since heavy atoms are ineffective at stopping neutrons, a mixture of light and heavy would be preferable; actually, experiments are now under way wherein uranium-oxide will be used. A university equipped with the necessary cyclotron has already arranged for the purchase of a cubic foot of uranium-oxide which, at one dollar a pound, the present commercial price, represents nearly seven hundred pounds and seven hundred dollars.

It is unfortunate that small-scale experiments cannot be carried out, perhaps, but small-scale experiments simply don't exist. Seven hundred pounds of uranium-oxide represents practically seven hundred pounds of uranium—and the available energy of three and one-half million tons of coal, or fourteen million tons of TNT.

Which will it be, coal or TNT? Don't know yet, of course, but coal, they believe. The reaction seems to have a half-life of fifteen seconds, and, since only a tiny portion of the mass can be treated with neutrons at the start, there would, of necessity, be a rather slow crescendo effect, as more and more atoms became supercharged with the destructive, blasting neutrons. So slow would the spread be, and so inconceivably violent the energy release for each atom attacked, that the entire mass of uranium-oxide would be converted into incandescent gas long, long before any more than a tiny fraction of the available mass were affected—and, once separated into innumerable small masses of uranium instead of one large mass, the reaction would be damped to extinction by escape without use of the necessary neutrons.

If they can start it—it will go. If it goes, it is self-limiting by self-dispersion. The techniques needed for balancing it at a commercial, usable level are not developed, but that is the province not of the atomic physicist, but of the new technician yet to come, with a new type of degree. The A.E.—the Atomic Engineer.

THE EDITOR.

Mr. Mattingly & Mr. Moore find folks appreciate good whiskey!

"Oh, Mr. Mattingly,
Oh, Mr. Mattingly,
I was stopped upon the highway
by a stranger

"Who said: 'Sir, my name is legion—
One of many in this region
Who will stick to M & M,
and never change, sir!'"

"Yes, Mr. Moore,
Yes, Mr. Moore,
There are thousands
who agree with him, you know...

"They like the way we slow-distill...
(We always have, and always will!)
And they like its mellow flavor...
and its price so really low!"

THE fame and popularity of Mattingly & Moore are due to its grand, old-fashioned flavor!

You see, M & M is ALL whiskey ... every drop *slow*-distilled. More, M & M is *a blend of straight whiskies* ... the kind of whiskey we think is best of all.

Ask for M & M, *today*... at your favorite bar or package store. Your first taste will show you why M & M has been famous down in Kentucky for more than 60 years ... why it is even *more famous today!* And remember ... the price is amazingly *low!*

Mattingly & Moore

Long on Quality—Short on Price!

A blend of straight whiskies—90 proof. Every drop is whiskey. Frankfort Distilleries, Incorporated, Louisville & Baltimore.

BLACK DESTROYER

By A. E. VAN VOGT

ON and on Coeurl prowled! The black, moonless, almost starless night yielded reluctantly before a grim reddish dawn that crept up from his left. A vague, dull light, it was, that gave no sense of approaching warmth, no comfort, nothing but a cold, diffuse lightness, slowly revealing a nightmare landscape.

Black, jagged rock and black, unliving plain took form around him, as a pale-red sun peered at last above the gro-

tesque horizon. It was then Coeurl recognized suddenly that he was on familiar ground.

He stopped short. Tenseness flamed along his nerves. His muscles pressed with sudden, unrelenting strength against his bones. His great forelegs —twice as long as his hindlegs— twitched with a shuddering movement that arched every razor-sharp claw. The thick tentacles that sprouted from his shoulders ceased their weaving undulation, and grew taut with anxious alertness.

Utterly appalled, he twisted his great cat head from side to side, while the little hairlike tendrils that formed each ear vibrated frantically, testing every vagrant breeze, every throb in the ether.

But there was no response, no swift tingling along his intricate nervous system, not the faintest suggestion anywhere of the presence of the all-necessary id. Hopelessly, Coeurl crouched, an enormous catlike figure silhouetted against the dim reddish skyline, like a distorted etching of a black tiger resting on a black rock in a shadow world.

He had known this day would come. Through all the centuries of restless search, this day had loomed ever nearer, blacker, more frightening—this inevitable hour when he must return to the point where he began his systematic hunt in a world almost depleted of id-creatures.

The truth struck in waves like an endless, rhythmic ache at the seat of his ego. When he had started, there had been a few id-creatures in every hundred square miles, to be mercilessly rooted out. Only too well Coeurl knew in this ultimate hour that he had missed none. There were no id-creatures left to eat. In all the hundreds of thousands of square miles that he had made his own by right of ruthless conquest— until no neighboring coeurl dared to question his sovereignty—there was no id to feed the otherwise immortal engine that was his body.

Square foot by square foot he had gone over it. And now—he recognized the knoll of rock just ahead, and the black rock bridge that formed a queer, curling tunnel to his right. It was in that tunnel he had lain for days, waiting for the simple-minded, snakelike id-creature to come forth from its hole in the rock to bask in the sun—his first kill after he had realized the absolute necessity of organized extermination.

He licked his lips in brief gloating memory of the moment his slavering jaws tore the victim into precious toothsome hits. But the dark fear of an idless universe swept the sweet remembrance from his consciousness, leaving only certainty of death.

He snarled audibly, a defiant, devilish sound that quavered on the air, echoed and re-echoed among the rocks, and shuddered back along his nerves—instinctive and hellish expression of his will to live.

And then—abruptly—it came.

HE SAW it emerge out of the distance on a long downward slant, a tiny glowing spot that grew enormously into a metal ball. The great shining globe hissed by above Coeurl, slowing visibly in quick deceleration. It sped over a black line of hills to the right, hovered almost motionless for a second, then sank down out of sight.

Coeurl exploded from his startled immobility. With tiger speed, he flowed down among the rocks. His round, black eyes burned with the horrible desire that was an agony within him. His ear tendrils vibrated a message of id in such tremendous quantities that his body felt sick with the pangs of his abnormal hunger.

The little red sun was a crimson ball in the purple-black heavens when he crept up from behind a mass of rock and gazed from its shadows at the crum-

bling, gigantic ruins of the city that sprawled below him. The silvery globe, in spite of its great size, looked strangely inconspicuous against that vast, fairy-like reach of ruins. Yet about it was a leashed aliveness, a dynamic quiescence that, after a moment, made it stand out, dominating the foreground. A massive, rock-crushing thing of metal, it rested on a cradle made by its own weight in the harsh, resisting plain which began abruptly at the outskirts of the dead metropolis.

Coeurl gazed at the strange, two-legged creatures who stood in little groups near the brilliantly lighted opening that yawned at the base of the ship. His throat thickened with the immediacy of his need; and his brain grew dark with the first wild impulse to burst forth in furious charge and smash these flimsy, helpless-looking creatures whose bodies emitted the id-vibrations.

Mists of memory stopped that mad rush when it was still only electricity surging through his muscles. Memory that brought fear in an acid stream of weakness, pouring along his nerves, poisoning the reservoirs of his strength. He had time to see that the creatures wore things over their real bodies, shimmering transparent material that glittered in strange, burning flashes in the rays of the sun.

Other memories came suddenly. Of dim days when the city that spread below was the living, breathing heart of an age of glory that dissolved in a single century before flaming guns whose wielders knew only that for the survivors there would be an ever-narrowing supply of id.

It was the remembrance of those guns that held him there, cringing in a wave of terror that blurred his reason. He saw himself smashed by balls of metal and burned by searing flame.

Came cunning—understanding of the presence of these creatures. This, Coeurl reasoned for the first time, was a scientific expedition from another star. In the olden days, the coeurls had thought of space travel, but disaster came too swiftly for it ever to be more than a thought.

Scientists meant investigation, not destruction. Scientists in their way were fools. Bold with his knowledge, he emerged into the open. He saw the creatures become aware of him. They turned and stared. One, the smallest of the group, detached a shining metal rod from a sheath, and held it casually in one hand. Coeurl loped on, shaken to his core by the action; but it was too late to turn back.

COMMANDER HAL MORTON heard little Gregory Kent, the chemist, laugh with the embarrassed half gurgle with which he invariably announced inner uncertainty. He saw Kent fingering the spindly metalite weapon.

Kent said: "I'll take no chances with anything as big as that."

Commander Morton allowed his own deep chuckle to echo along the communicators. "That," he grunted finally, "is one of the reasons why you're on this expedition, Kent—because you never leave anything to chance."

His chuckle trailed off into silence. Instinctively, as he watched the monster approach them across that black rock plain, he moved forward until he stood a little in advance of the others, his huge form bulking the transparent metalite suit. The comments of the men pattered through the radio communicator into his ears:

"I'd hate to meet that baby on a dark night in an alley."

"Don't be silly. This is obviously an intelligent creature. Probably a member of the ruling race."

"It looks like nothing else than a big cat, if you forget those tentacles sticking out from its shoulders, and make allowances for those monster forelegs."

"Its physical development," said a

voice, which Morton recognized as that of Siedel, the psychologist, "presupposes an animallike adaptation to surroundings, not an intellectual one. On the other hand, its coming to us like this is not the act of an animal but of a creature possessing a mental awareness of our possible identity. You will notice that its movements are stiff, denoting caution, which suggests fear and consciousness of our weapons. I'd like to get a good look at the end of its tentacles. If they taper into handlike appendages that can really grip objects, then the conclusion would be inescapable that it is a descendant of the inhabitants of this city. It would be a great help if we could establish communication with it, even though appearances indicate that it has degenerated into a historyless primitive."

Coeurl stopped when he was still ten feet from the foremost creature. The sense of id was so overwhelming that his brain drifted to the ultimate verge of chaos. He felt as if his limbs were bathed in molten liquid; his very vision was not quite clear, as the sheer sensuality of his desire thundered through his being.

The men—all except the little one with the shining metal rod in his fingers—came closer. Coeurl saw that they were frankly and curiously examining him. Their lips were moving, and their voices beat in a monotonous, meaningless rhythm on his ear tendrils. At the same time he had the sense of waves of a much higher frequency—his own communication level—only it was a machinelike clicking that jarred his brain. With a distinct effort to appear friendly, he broadcast his name from his ear tendrils, at the same time pointing at himself with one curving tentacle.

Gourlay, chief of communications, drawled: "I got a sort of static in my radio when he wiggled those hairs, Morton. Do you think—"

"Looks very much like it," the leader answered the unfinished question. "That means a job for you, Gourlay. If it speaks by means of radio waves, it might not be altogether impossible that you can create some sort of television picture of its vibrations, or teach him the Morse code."

"Ah," said Siedel. "I was right. The tentacles each develop into seven strong fingers. Provided the nervous system is complicated enough, those fingers could, with training, operate any machine."

MORTON said: "I think we'd better go in and have some lunch. Afterward, we've got to get busy. The material men can set up their machines and start gathering data on the planet's metal possibilities, and so on. The others can do a little careful exploring. I'd like some notes on architecture and on the scientific development of this race, and particularly what happened to wreck the civilization. On earth civilization after civilization crumbled, but always a new one sprang up in its dust. Why didn't that happen here? Any questions?"

"Yes. What about pussy? Look, he wants to come in with us."

Commander Morton frowned, an action that emphasized the deep-space pallor of his face. "I wish there was some way we could take it in with us, without forcibly capturing it. Kent, what do you think?"

"I think we should first decide whether it's an it or a him, and call it one or the other. I'm in favor of him. As for taking him in with us—" The little chemist shook his head decisively. "Impossible. This atmosphere is twenty-eight percent chlorine. Our oxygen would be pure dynamite to his lungs."

The commander chuckled. "He doesn't believe that, apparently." He watched the catlike monster follow the first two men through the great door. The men kept an anxious distance from

him, then glanced at Morton questioningly. Morton waved his hand. "O. K. Open the second lock and let him get a whiff of the oxygen. That'll cure him."

A moment later, he cursed his amazement. "By Heaven, he doesn't even notice the difference! That means he hasn't any lungs, or else the chlorine is not what his lungs use. Let him in! You bet he can go in! Smith, here's a treasure house for a biologist—harmless enough if we're careful. We can always handle him. But what a metabolism!"

Smith, a tall, thin, bony chap with a long, mournful face, said in an oddly forceful voice: "In all our travels, we've found only two higher forms of life. Those dependent on chlorine, and those who need oxygen—the two elements that support combustion. I'm prepared to stake my reputation that no complicated organism could ever adapt itself to both gases in a natural way. At first thought I should say here is an extremely advanced form of life. This race long ago discovered truths of biology that we are just beginning to suspect. Morton, we mustn't let this creature get away if we can help it."

"If his anxiety to get inside is any criterion," Commander Morton laughed, "then our difficulty will be to get rid of him."

He moved into the lock with Coeurl and the two men. The automatic machinery hummed; and in a few minutes they were standing at the bottom of a series of elevators that led up to the living quarters.

"Does that go up?" One of the men flicked a thumb in the direction of the monster.

"Better send him up alone, if he'll go in."

Coeurl offered no objection, until he heard the door slam behind him; and the closed cage shot upward. He whirled with a savage snarl, his reason swirling into chaos. With one leap, he pounced at the door. The metal bent under his plunge, and the desperate pain maddened him. Now, he was all trapped animal. He smashed at the metal with his paws, bending it like so much tin. He tore great bars loose with his thick tentacles. The machinery screeched; there were horrible jerks as the limitless power pulled the cage along in spite of projecting pieces of metal that scraped the outside walls. And then the cage stopped, and he snatched off the rest of the door and hurtled into the corridor.

He waited there until Morton and the men came up with drawn weapons. "We're fools," Morton said. "We should have shown him how it works. He thought we'd double-crossed him."

He motioned to the monster, and saw the savage glow fade from the coal-black eyes as he opened and closed the door with elaborate gestures to show the operation.

Coeurl ended the lesson by trotting into the large room to his right. He lay down on the rugged floor, and fought down the electric tautness of his nerves and muscles. A very fury of rage against himself for his fright consumed him. It seemed to his burning brain that he had lost the advantage of appearing a mild and harmless creature. His strength must have startled and dismayed them.

It meant greater danger in the task which he now knew he must accomplish: To kill everything in the ship, and take the machine back to their world in search of unlimited id.

WITH unwinking eyes, Coeurl lay and watched the two men clearing away the loose rubble from the metal doorway of the huge old building. His whole body ached with the hunger of his cells for id. The craving tore through his palpitant muscles, and throbbed like a living thing in his brain. His every nerve quivered to be off after the men who had wandered into the city. One of them, he knew, had gone—alone.

The dragging minutes fled; and still he restrained himself, still he lay there watching, aware that the men knew he watched. They floated a metal machine from the ship to the rock mass that blocked the great half-open door, under the direction of a third man. No flicker of their fingers escaped his fierce stare, and slowly, as the simplicity of the machinery became apparent to him, contempt grew upon him.

He knew what to expect finally, when the flame flared in incandescent violence and ate ravenously at the hard rock beneath. But in spite of his preknowledge, he deliberately jumped and snarled as if in fear, as that white heat burst forth. His ear tendrils caught the laughter of the men, their curious pleasure at his simulated dismay.

The door was released, and Morton came over and went inside with the third man. The latter shook his head.

"It's a shambles. You can catch the drift of the stuff. Obviously, they used atomic energy, but . . . but it's in wheel form. That's a peculiar development. In our science, atomic energy brought in the nonwheel machine. It's possible that here they've progressed *further* to a new type of wheel mechanics. I hope their libraries are better preserved than this, or we'll never know. What could have happened to a civilization to make it vanish like this?"

A third voice broke through the communicators: "This is Siedel. I heard your question, Pennons. Psychologically and sociologically speaking, the only reason why a territory becomes uninhabited is lack of food."

"But they're so advanced scientifically, why didn't they develop space flying and go elsewhere for their food?"

"Ask Gunlie Lester," interjected Morton. "I heard him expounding some theory even before we landed."

The astronomer answered the first call. "I've still got to verify all my facts, but this desolate world is the only planet revolving around that miserable red sun. There's nothing else. No moon, not even a planetoid. And the nearest star system is *nine hundred light-years* away.

"So tremendous would have been the problem of the ruling race of this world, that in one jump they would not only have had to solve interplanetary but interstellar space traveling. When you consider how slow our own development was—first the moon, then Venus—each success leading to the next, and after centuries to the nearest stars; and last of all to the anti-accelerators that permitted galactic travel. Considering all this, I maintain it would be impossible for any race to create such machines without practical experience. And, with the nearest star so far away, they had no incentive for the space adventuring that makes for experience."

COEURL was trotting briskly over to another group. But now, in the driving appetite that consumed him, and in the frenzy of his high scorn, he paid no attention to what they were doing. Memories of past knowledge, jarred into activity by what he had seen, flowed into his consciousness in an ever developing and more vivid stream.

From group to group he sped, a nervous dynamo—jumpy, sick with his awful hunger. A little car rolled up, stopping in front of him, and a formidable camera whirred as it took a picture of him. Over on a mound of rock, a gigantic telescope was rearing up toward the sky. Nearby, a disintegrating machine drilled its searing fire into an ever-deepening hole, down and down, straight down.

Coeurl's mind became a blur of things he watched with half attention. And ever more imminent grew the moment when he knew he could no longer carry on the torture of acting. His brain strained with an irresistible impatience; his body burned with the fury of his

eagerness to be off after the man who had gone alone into the city.

He could stand it no longer. A green foam misted his mouth, maddening him. He saw that, for the bare moment, nobody was looking.

Like a shot from a gun, he was off. He floated along in great, gliding leaps, a shadow among the shadows of the rocks. In a minute, the harsh terrain hid the spaceship and the two-legged beings.

Coeurl forgot the ship, forgot everything but his purpose, as if his brain had been wiped clear by a magic, memory-erasing brush. He circled widely, then raced into the city, along deserted streets, taking short cuts with the ease of familiarity, through gaping holes in time-weakened walls, through long corridors of moldering buildings. He slowed to a crouching lope as his ear tendrils caught the id vibrations.

Suddenly, he stopped and peered from a scatter of fallen rock. The man was standing at what must once have been a window, sending the glaring rays of his flashlight into the gloomy interior. The flashlight clicked off. The man, a heavy-set, powerful fellow, walked off with quick, alert steps. Coeurl didn't like that alertness. It presaged trouble; it meant lightning reaction to danger.

Coeurl waited till the human being had vanished around a corner, then he padded into the open. He was running now, tremendously faster than a man could walk, because his plan was clear in his brain. Like a wraith, he slipped down the next street, past a long block of buildings. He turned the first corner at top speed; and then, with dragging belly, crept into the hall-darkness between the building and a huge chunk of débris. The street ahead was barred by a solid line of loose rubble that made it like a valley, ending in a narrow, bottlelike neck. The neck had its outlet just below Coeurl.

His ear tendrils caught the low-frequency waves of whistling. The sound throbbed through his being; and suddenly terror caught with icy fingers at his brain. The man would have a gun. Suppose he leveled one burst of atomic energy—*one burst*—before his own muscles could whip out in murder fury.

A little shower of rocks streamed past. And then the man was beneath him. Coeurl reached out and struck a single crushing blow at the shimmering transparent headpiece of the spacesuit. There was a tearing sound of metal and a gushing of blood. The man doubled up as if part of him had been telescoped. For a moment, his bones and legs and muscles combined miraculously to keep him standing. Then he crumpled with a metallic clank of his space armor.

Fear completely evaporated, Coeurl leaped out of hiding. With ravenous speed, he smashed the metal and the body within it to bits. Great chunks of metal, torn piecemeal from the suit, sprayed the ground. Bones cracked. Flesh crunched.

It was simple to tune in on the vibrations of the id, and to create the violent chemical disorganization that freed it from the crushed bone. The id was, Coeurl discovered, mostly in the bone.

He felt revived, almost reborn. Here was more food than he had had in the whole past year.

Three minutes, and it was over, and Coeurl was off like a thing fleeing dire danger. Cautiously, he approached the glistening globe from the opposite side to that by which he had left. The men were all busy at their tasks. Gliding noiselessly, Coeurl slipped unnoticed up to a group of men.

MORTON stared down at the horror of tattered flesh, metal and blood on the rock at his feet, and felt a tightening in his throat that prevented speech. He heard Kent say:

"He *would* go alone, damn him!"

Coeurl growled angrily—cannily—and dashed the contents of the bowl in the man's face.

Illustrated by Kramer

The little chemist's voice held a sob imprisoned; and Morton remembered that Kent and Jarvey had chummed together for years in the way only two men can.

"The worst part of it is," shuddered one of the men, "it looks like a senseless murder. His body is spread out like little lumps of flattened jelly, but it seems to be all there. I'd almost wager that if we weighed everything here, there'd still be one hundred and seventy-five pounds by earth gravity. That'd be about one hundred and seventy pounds here."

Smith broke in, his mournful face lined with gloom: "The killer attacked Jarvey, and then discovered his flesh was alien—uneatable. Just like our big cat. Wouldn't eat anything we set before him—" His words died out in sudden, queer silence. Then he said slowly: "Say, what about that creature? He's big enough and strong enough to have done this with his own little paws."

Morton frowned. "It's a thought. After all, he's the only living thing we've seen. We can't just execute him on suspicion, of course—"

"Besides," said one of the men, "he was never out of my sight."

Before Morton could speak, Siedel, the psychologist, snapped, "Positive about that?"

The man hesitated. "Maybe he was for a few minutes. He was wandering around so much, looking at everything."

"Exactly," said Siedel with satisfaction. He turned to Morton. "You see, commander, I, too, had the impression that he was always around; and yet, thinking back over it, I find gaps. There were moments—probably long minutes—when he was completely out of sight."

Morton's face was dark with thought, as Kent broke in fiercely: "I say, take no chances. Kill the brute on suspicion before he does any more damage."

Morton said slowly: "Korita, you've been wandering around with Cranessy and Van Horne. Do you think pussy is a descendant of the ruling class of this planet?"

The tall Japanese archeologist stared at the sky as if collecting his mind. "Commander Morton," he said finally, respectfully, "there is a mystery here. Take a look, all of you, at that majestic skyline. Notice the almost Gothic outline of the architecture. In spite of the megalopolis which they created, these people were close to the soil. The buildings are not simply ornamented. They are ornamental in themselves. Here is the equivalent of the Doric column, the Egyptian pyramid, the Gothic cathedral, growing out of the ground, earnest, big with destiny. If this lonely, desolate world can be regarded as a mother earth, then the land had a warm, a spiritual place in the hearts of the race.

"The effect is emphasized by the winding streets. Their machines prove they were mathematicians, but they were artists first; and so they did not create the geometrically designed cities of the ultra-sophisticated world metropolis. There is a genuine artistic abandon, a deep joyous emotion written in the curving and unmathematical arrangements of houses, buildings and avenues; a sense of intensity, of divine belief in an inner certainty. This is not a decadent, hoary-with-age civilization, but a young and vigorous culture, confident, strong with purpose.

"There it ended. Abruptly, as if at this point culture had its Battle of Tours, and began to collapse like the ancient Mohammedan civilization. Or as if in one leap it spanned the centuries and entered the period of contending states. In the Chinese civilization that period occupied 480-230 B. C., at the end of which the State of Tsin saw the beginning of the Chinese Empire. This phase Egypt experienced between 1780-1580 B. C., of which the last century was the 'Hyksos'—unmentionable—time. The classical experienced it

from Chæronea—338—and, at the pitch of horror, from the Gracchi—133—to Actium—31 B. C. The West European Americans were devastated by it in the nineteenth and twentieth centuries, and modern historians agree that, nominally, we entered the same phase fifty years ago; though, of course, we have solved the problem.

"You may ask, commander, what has all this to do with your question? My answer is: there is no record of a culture entering abruptly into the period of contending states. It is always a slow development; and the first step is a merciless questioning of all that was once held sacred. Inner certainties cease to exist, are dissolved before the ruthless probings of scientific and analytic minds. The skeptic becomes the highest type of being.

"I say that this culture ended abruptly in its most flourishing age. The sociological effects of such a catastrophe would be a sudden vanishing of morals, a reversion to almost bestial criminality, unleavened by any sense of ideal, a callous indifference to death. If this . . . this pussy is a descendant of such a race, then he will be a cunning creature, a thief in the night, a cold-blooded murderer, who would cut his own brother's throat for gain."

"THAT'S enough!" It was Kent's clipped voice. "Commander, I'm willing to act the rôle of executioner."

Smith interrupted sharply: "Listen, Morton, you're not going to kill that cat yet, even if he is guilty. He's a biological treasure house."

Kent and Smith were glaring angrily at each other. Morton frowned at them thoughtfully, then said: "Korita, I'm inclined to accept your theory as a working basis. But one question: Pussy comes from a period earlier than our own? That is, we are entering the highly civilized era of our culture, while he became suddenly historyless in the most vigorous period of his. *But* it is possible that his culture is a later one on this planet than ours is in the galactic-wide system we have civilized?"

"Exactly. His may be the middle of the tenth civilization of his world; while ours is the end of the eighth sprung from earth, each of the ten, of course, having been builded on the ruins of the one before it."

"In that case, pussy would not know anything about the skepticism that made it possible for us to find him out so positively as a criminal and murderer?"

"No; it would be literally magic to him."

Morton was smiling grimly. "Then I think you'll get your wish, Smith. We'll let pussy live; and if there are any fatalities, now that we know him, it will be due to rank carelessness. There's just the chance, of course, that we're wrong. Like Siedel, I also have the impression that he was always around. But now—we can't leave poor Jarvey here like this. We'll put him in a coffin and bury him."

"No, we won't!" Kent barked. He flushed. "I beg your pardon, commander. I didn't mean it that way. I maintain pussy wanted something from that body. It looks to be all there, but something must be missing. I'm going to find out what, and pin this murder on him so that you'll have to believe it beyond the shadow of a doubt."

IT WAS late night when Morton looked up from a book and saw Kent emerge through the door that led from the laboratories below.

Kent carried a large, flat bowl in his hands; his tired eyes flashed across at Morton, and he said in a weary, yet harsh, voice: "Now watch!"

He started toward Coeurl, who lay sprawled on the great rug, pretending to be asleep.

Morton stopped him. "Wait a minute, Kent. Any other time, I wouldn't

question your actions, but you look ill; you're overwrought. What have you got there?"

Kent turned, and Morton saw that his first impression had been but a flashing glimpse of the truth. There were dark pouches under the little chemist's gray eyes—eyes that gazed feverishly from sunken cheeks in an ascetic face.

"I've found the missing element," Kent said. "It's phosphorus. There wasn't so much as a square millimeter of phosphorus left in Jarvey's bones. Every bit of it had been drained out—by what superchemistry I don't know. There are ways of getting phosphorus out of the human body. For instance, a quick way was what happened to the workman who helped build this ship. Remember, he fell into fifteen tons of molten metalite—at least, so his relatives claimed—but the company wouldn't pay compensation until the metalite, on analysis, was found to contain a high percentage of phosphorus—"

"What about the bowl of food?" somebody interrupted. Men were putting away magazines and books, looking up with interest.

"It's got organic phosphorus in it. He'll get the scent, or whatever it is that he uses instead of scent—"

"I think he gets the vibrations of things," Gourlay interjected lazily. "Sometimes, when he wiggles those tendrils, I get a distinct static on the radio. And then, again, there's no reaction, just as if he's moved higher or lower on the wave scale. He seems to control the vibrations at will."

Kent waited with obvious impatience until Gourlay's last word, then abruptly went on: "All right, then, when he gets the vibration of the phosphorus and reacts to it like an animal, then—well, we can decide what we've proved by his reaction. Can I go ahead, Morton?"

"There are three things wrong with your plan," Morton said. "In the first place, you seem to assume that he is only animal; you seem to have forgotten he may not be hungry after Jarvey; you seem to think that he will not be suspicious. But set the bowl down. His reaction may tell us something."

Coeurl stared with unblinking black eyes as the man set the bowl before him. His ear tendrils instantly caught the id-vibrations from the contents of the bowl—and he gave it not even a second glance.

He recognized this two-legged being as the one who had held the weapon that morning. Danger! With a snarl, he floated to his feet. He caught the bowl with the fingerlike appendages at the end of one looping tentacle, and emptied its contents into the face of Kent, who shrank back with a yell.

Explosively, Coeurl flung the bowl aside and snapped a hawser-thick tentacle around the cursing man's waist. He didn't bother with the gun that hung from Kent's belt. It was only a vibration gun, he sensed—atomic powered, but not an atomic disintegrator. He tossed the kicking Kent onto the nearest couch—and realized with a hiss of dismay that he should have disarmed the man.

Not that the gun was dangerous—but, as the man furiously wiped the gruel from his face with one hand, he reached with the other for his weapon. Coeurl crouched back as the gun was raised slowly and a white beam of flame was discharged at his massive head.

His ear tendrils hummed as they canceled the efforts of the vibration gun. His round, black eyes narrowed as he caught the movement of men reaching for their metalite guns. Morton's voice lashed across the silence.

"Stop!"

KENT clicked off his weapon; and Coeurl crouched down, quivering with fury at this man who had forced him to reveal something of his power.

"Kent," said Morton coldly, "you're not the type to lose your head. You deliberately tried to kill pussy, knowing that the majority of us are in favor of keeping him alive. You know what our rule is: If anyone objects to my decisions, he must say so *at the time.* If the majority object, my decisions are overruled. In this case, no one but you objected, and, therefore, your action in taking the law into your own hands is most reprehensible, and automatically debars you from voting for a year."

Kent stared grimly at the circle of faces. "Korita was right when he said ous was a highly civilized age. It's decadent." Passion flamed harshly in his voice. "My God, isn't there a man here who can see the horror of the situation? Jarvey dead only a few hours, and this creature, whom we all know to be guilty, lying there unchained, planning his next murder; and the victim is right here in this room. What kind of men are we—fools, cynics, ghouls—or is it that our civilization is so steeped in reason that we can contemplate a murderer sympathetically?"

He fixed brooding eyes on Coeurl. "You were right, Morton, that's no animal. That's a devil from the deepest hell of this forgotten planet, whirling its solitary way around a dying sun."

"Don't go melodramatic on us," Morton said. "Your analysis is all wrong, so far as I am concerned. We're not ghouls or cynics; we're simply scientists, and pussy here is going to be studied. Now that we suspect him, we doubt his ability to trap any of us. One against a hundred hasn't a chance." He glanced around. "Do I speak for all of us?"

"Not for me, commander!" It was Smith who spoke, and, as Morton stared in amazement, he continued: "In the excitement and momentary confusion, no one seems to have noticed that when Kent fired his vibration gun, the beam hit this creature squarely on his cat head—and didn't hurt him."

Morton's amazed glance went from Smith to Coeurl, and back to Smith again. "Are you certain it hit him? As you say, it all happened so swiftly—when pussy wasn't hurt I simply assumed that Kent had missed him."

"He hit him in the face," Smith said positively. "A vibration gun, of course, can't even kill a man right away—but it can injure him. There's no sign of injury on pussy, though, not even a singed hair."

"Perhaps his skin is a good insulation against heat of any kind."

"Perhaps. But in view of our uncertainty, I think we should lock him up in the cage."

While Morton frowned darkly in thought, Kent spoke up. "Now you're talking sense, Smith."

Morton asked: "Then you would be satisfied, Kent, if we put him in the cage?"

Kent considered, finally: "Yes. If four inches of micro-steel can't hold him, we'd better give him the ship."

COEURL followed the men as they went out into the corridor. He trotted docilely along as Morton unmistakably motioned him through a door he had not hitherto seen. He found himself in a square, solid metal room. The door clanged metallically behind him; he felt the flow of power as the electric lock clicked home.

His lips parted in a grimace of hate, as he realized the trap, but he gave no other outward reaction. It occurred to him that he had progressed a long way from the sunk-into-primitiveness creature who, a few hours before, had gone incoherent with fear in an elevator cage. Now, a thousand memories of his powers were reawakened in his brain; ten thousand cunnings were, after ages of disuse, once again part of his very being.

He sat quite still for a moment on

the short, heavy haunches into which his body tapered, his ear tendrils examining his surroundings. Finally, he lay down, his eyes glowing with contemptuous fire. The fools! The poor fools!

It was about an hour later when he heard the man—Smith—fumbling overhead. Vibrations poured upon him, and for just an instant he was startled. He leaped to his feet in pure terror—and then realized that the vibrations *were* vibrations, not atomic explosions. Somebody was taking pictures of the inside of his body.

He crouched down again, but his ear tendrils vibrated, and he thought contemptuously: the silly fool would be surprised when he tried to develop those pictures.

After a while the man went away, and for a long time there were noises of men doing things far away. That, too, died away slowly.

Coeurl lay waiting, as he felt the silence creep over the ship. In the long ago, before the dawn of immortality, the coeurls, too, had slept at night; and the memory of it had been revived the day before when he saw some of the men dozing. At last, the vibration of two pairs of feet, pacing, pacing endlessly, was the only human-made frequency that throbbed on his ear tendrils.

Tensely, he listened to the two watchmen. The first one walked slowly past the cage door. Then about thirty feet behind him came the second. Coeurl sensed the alertness of these men; knew that he could never surprise either while they walked separately. It meant—he must be doubly careful!

Fifteen minutes, and they came again. The moment they were past, he switched his senses from their vibrations to a vastly higher range. The pulsating violence of the atomic engines stammered its soft story to his brain. The electric dynamos hummed their muffled song of pure power. He felt the whisper of that flow through the wires in the walls of his cage, and through the electric lock of his door. He forced his quivering body into straining immobility, his senses seeking, searching, to tune in on that sibilant tempest of energy. Suddenly, his ear tendrils vibrated in harmony—he caught the surging change into shrillness of that rippling force wave.

There was a sharp click of metal on metal. With a gentle touch of one tentacle, Coeurl pushed open the door, and glided out into the dully gleaming corridor. For just a moment, he felt contempt, a glow of superiority, as he thought of the stupid creatures who dared to match their wit against a coeurl. And in that moment, he suddenly thought of other coeurls. A queer, exultant sense of race pounded through his being; the driving hate of centuries of ruthless competition yielded reluctantly before pride of kinship with the future rulers of all space.

SUDDENLY, he felt weighed down by his limitations, his need for other coeurls, his aloneness—one against a hundred, with the stake all eternity; the starry universe itself beckoned his rapacious, vaulting ambition. If he failed, there would never be a second chance—no time to revive long-rotted machinery, and attempt to solve the secret of space travel.

He padded along on tensed paws—through the salon—into the next corridor—and came to the first bedroom door. It stood half open. One swift flow of synchronized muscles, one swiftly lashing tentacle that caught the unresisting throat of the sleeping man, crushing it; and the lifeless head rolled crazily, the body twitched once.

Seven bedrooms; seven dead men. It was the seventh taste of murder that brought a sudden return of lust, a pure, unbounded desire to kill, return of a

millennium-old habit of destroying everything containing the precious id.

As the twelfth man slipped convulsively into death, Coeurl emerged abruptly from the sensuous joy of the kill to the sound of footsteps.

They were not near—that was what brought wave after wave of fright swirling into the chaos that suddenly became his brain.

THE WATCHMEN were coming slowly along the corridor toward the door of the cage where he had been imprisoned. In a moment, the first man would see the open door—and sound the alarm.

Coeurl caught at the vanishing remnants of his reason. With frantic speed, careless now of accidental sounds, he raced—along the corridor with its bedroom doors—through the salon. He emerged into the next corridor, cringing in awful anticipation of the atomic flame he expected would stab into his face.

The two men were together, standing side by side. For on single instant, Coeurl could scarcely believe his tremendous good luck. Like a fool the second had come running when he saw the other stop before the open door. They looked up, paralyzed, before the nightmare of claws and tentacles, the ferocious cat head and hate-filled eyes.

The first man went for his gun, but the second, physically frozen before the doom he saw, uttered a shriek, a shrill cry of horror that floated along the corridors—and ended in a curious gurgle, as Coeurl flung the two corpses with one irresistible motion the full length of the corridor. He didn't want the dead bodies found near the cage. That was his one hope.

Shaking in every nerve and muscle, conscious of the terrible error he had made, unable to think coherently, he plunged into the cage. The door clicked softly shut behind him. Power flowed once more through the electric lock.

He crouched tensely, simulating sleep, as he heard the rush of many feet, caught the vibration of excited voices. He knew when somebody actuated the cage audioscope and looked in. A few moments now, and the other bodies would be discovered.

"SIEDEL gone!" Morton said numbly. "What are we going to do without Siedel? And Breckenridge! And Coulter and— Horrible!"

He covered his face with his hands, but only for an instant. He looked up grimly, his heavy chin outthrust as he stared into the stern faces that surrounded him. "If anybody's got so much as a germ of an idea, bring it out."

"Space madness!"

"I've thought of that. But there hasn't been a case of a man going mad for fifty years. Dr. Eggert will test everybody, of course, and right now he's looking at the bodies with that possibility in mind."

As he finished, he saw the doctor coming through the door. Men crowded aside to make way for him.

"I heard you, commander," Dr. Eggert said, "and I think I can say right now that the space-madness theory is out. The throats of these men have been squeezed to a jelly. No human being could have exerted such enormous strength without using a machine."

Morton saw that the doctor's eyes kept looking down the corridor, and he shook his head and groaned:

"It's no use suspecting pussy, doctor. He's in his cage, pacing up and down. Obviously heard the racket and— Man alive! You can't suspect him. That cage was built to hold literally *anything*—four inches of micro-steel—and there's not a scratch on the door. Kent, even you won't say, 'Kill him on suspicion,' because there can't be any sus-

picion, unless there's a new science here, beyond anything we can imagine—"

"On the contrary," said Smith flatly, "we have all the evidence we need. I used the telefluor on him—you know the arrangement we have on top of the cage—and tried to take some pictures. They just blurred. Pussy jumped when the telefluor was turned on, as if he felt the vibrations.

"You all know what Gourlay said before? This beast can apparently receive and send vibrations of any lengths. The way he dominated the power of Kent's gun is final proof of his special ability to interfere with energy."

"What in the name of all the hells have we got here?" One of the men groaned. "Why, if he can control that power, and send it out in any vibrations, there's nothing to stop him killing all of us."

"Which proves," snapped Morton, "that he isn't invincible, or he would have done it long ago."

Very deliberately, he walked over to the mechanism that controlled the prison cage.

"You're not going to open the door!" Kent gasped, reaching for his gun.

"No, but if I pull this switch, electricity will flow through the floor, and electrocute whatever's inside. We've never had to use this before, so you had probably forgotten about it."

He jerked the switch hard over. Blue fire flashed from the metal, and a bank of fuses above his head exploded with a single bang.

Morton frowned. "That's funny. Those fuses shouldn't have blown! Well, we can't even look in, now. That wrecked the audios, too."

Smith said: "If he could interfere with the electric lock, enough to open the door, then he probably probed every possible danger and was ready to interfere when you threw that switch."

"At least, it proves he's vulnerable to our energies!" Morton smiled grimly. "Because he rendered them harmless. The important thing is, we've got him behind four inches of the toughest of metal. At the worst we can open the door and ray him to death. But first, I think we'll try to use the telefluor power cable—"

A COMMOTION from inside the cage interrupted his words. A heavy body crashed against a wall, followed by a dull thump.

"He knows what we were trying to do!" Smith grunted to Morton. "And I'll bet it's a very sick pussy in there. What a fool he was to go back into that cage and does he realize it!"

The tension was relaxing; men were smiling nervously, and there was even a ripple of humorless laughter at the picture Smith drew of the monster's discomfiture.

"What I'd like to know," said Pennons, the engineer, "is, why did the telefluor meter dial jump and waver at full power when pussy made that noise? It's right under my nose here, and the dial jumped like a house afire!"

There was silence both without and within the cage, then Morton said: "It may mean he's coming out. Back, everybody, and keep your guns ready. Pussy was a fool to think he could conquer a hundred men, but he's by far the most formidable creature in the galactic system. He may come out of that door, rather than die like a rat in a trap. And he's just tough enough to take some of us with him—if we're not careful."

The men backed slowly in a solid body; and somebody said: "That's funny. I thought I heard the elevator."

"Elevator!" Morton echoed. "Are you sure, man?"

"Just for a moment I was!" The man, a member of the crew, hesitated. "We were all shuffling our feet—"

"Take somebody with you, and go look. Bring whoever dared to run off back here—"

There was a jar, a horrible jerk, as the whole gigantic body of the ship careened under them. Morton was flung to the floor with a violence that stunned him. He fought back to consciousness, aware of the other men lying all around him. He shouted: "Who the devil started those engines!"

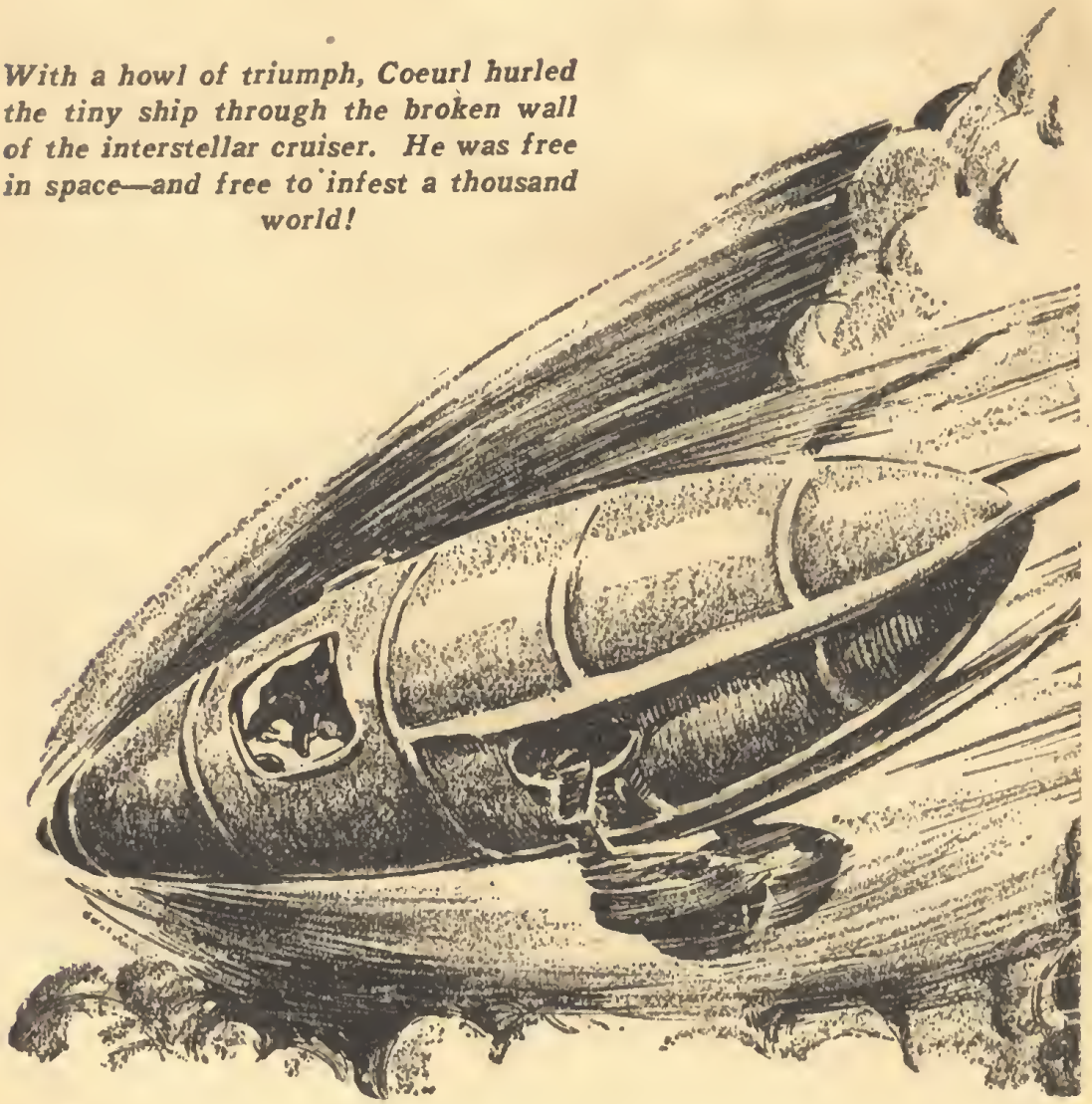
The agonizing acceleration continued; his feet dragged with awful exertion, as he fumbled with the nearest audioscope, and punched the engine-room number. The picture that flooded onto the screen brought a deep bellow to his lips:

"It's pussy! He's in the engine room —and we're heading straight out into space."

The screen went black even as he spoke, and he could see no more.

IT WAS Morton who first staggered across the salon floor to the supply room where the spacesuits were kept. After fumbling almost blindly into his own suit, he cut the effects of the body-torturing acceleration, and brought suits to the semiconscious men on the floor. In a few moments, other men were assisting him; and then it was only a matter of minutes before everybody was clad in metalite, with anti-acceleration motors running at half power.

It was Morton then who, after first looking into the cage, opened the door



With a howl of triumph, Coeurl hurled the tiny ship through the broken wall of the interstellar cruiser. He was free in space—and free to infest a thousand world!

and stood, silent as the others crowded about him, to stare at the gaping hole in the real wall. The hole was a frightful thing of jagged edges and horribly bent metal, and it opened upon another corridor.

"I'll swear," whispered Pennons, "that it's impossible. The ten-ton hammer in the machine shops couldn't more than dent four inches of micro with one blow—and we only heard one. It would take at least a minute for an atomic disintegrator to do the job. Morton, this is a super-being."

Morton saw that Smith was examining the break in the wall. The biologist looked up. "If only Breckenridge weren't dead! We need a metallurgist to explain this. Look!"

He touched the broken edge of the metal. A piece crumbled in his finger and slithered away in a fine shower of dust to the floor. Morton noticed for the first time that there was a little pile of metallic débris and dust.

"You've hit it." Morton nodded. "No miracle of strength here. The monster merely used his special powers to interfere with the electronic tensions holding the metal together. That would account, too, for the drain on the telefluor power cable that Pennons noticed. The thing used the power with his body as a transforming medium, smashed through the wall, ran down the corridor to the elevator shaft, and so down to the engine room."

"In the meantime, commander," Kent said quietly, "we are faced with a superbeing in control of the ship, completely dominating the engine room, and its almost unlimited power, and in possession of the best part of the machine shops."

Morton felt the silence, while the men pondered the chemist's words. Their anxiety was a tangible thing that lay heavily upon their faces; in every expression was the growing realization that here was the ultimate situation in their lives; their very existence was at stake, and perhaps much more. Morton voiced the thought in everybody's mind:

"Suppose he wins. He's utterly ruthless, and he probably sees galactic power within his grasp."

"Kent is wrong," barked the chief navigator. "The thing doesn't dominate the engine room. We've still got the control room, and that gives us *first* control of all the machines. You fellows may not know the mechanical set-up we have; but, though he can eventually disconnect us, we can cut off

all the switches in the engine room *now.* Commander, why didn't you just shut off the power instead of putting us into spacesuits? At the very least you could have adjusted the ship to the acceleration."

"For two reasons," Morton answered. "Individually, we're safer within the force fields of our spacesuits. And we can't afford to give up our advantages in panicky moves."

"Advantages. What other advantages have we got?"

"We know things about him," Morton replied. "And right now, we're going to make a test. Pennons, detail five men to each of the four approaches to the engine room. Take atomic disintegrators to blast through the big doors. They're all shut, I noticed. He's locked himself in.

"Selenski, you go up to the control room and shut off everything except the drive engines. Gear them to the master switch, and shut them off all at once. One thing, though—leave the acceleration on full blast. No anti-acceleration must be applied to the ship. Understand?"

"Aye, sir!" The pilot saluted.

"And report to me through the communicators if any of the machines start to run again." He faced the men. "I'm going to lead the main approach. Kent, you take No. 2; Smith, No. 3, and Pennons, No. 4. We're going to find out right now if we're dealing with unlimited science, or a creature limited like the rest of us. I'll bet on the last possibility."

MORTON had an empty sense of walking endlessly, as he moved, a giant of a man in his transparent space armor, along the glistening metal tube that was the main corridor of the engine-room floor. Reason told him the creature had already shown feet of clay, yet the feeling that here was an invincible being persisted.

He spoke into the communicator: "It's no use trying to sneak up on him. He can probably hear a pin drop. So just wheel up your units. He hasn't been in that engine room long enough to do anything.

"As I've said, this is largely a test attack. In the first place, we could never forgive ourselves if we didn't try to conquer him now, before he's had time to prepare against us. But, aside from the possibility that we can destroy him immediately, I have a theory.

"The idea goes something like this: Those doors are built to withstand accidental atomic explosions, and it will take fifteen minutes for the atomic disintegrators to smash them. During that period the monster will have no power. True, the drive will be on, but that's straight atomic explosion. My theory is, he can't touch stuff like that; and in a few minutes you'll see what I mean —I hope."

His voice was suddenly crisp: "Ready, Selenski?"

"Aye, ready."

"Then cut the master switch."

The corridor—the whole ship, Morton knew—was abruptly plunged into darkness. Morton clicked on the dazzling light of his spacesuit; the other men did the same, their faces pale and drawn.

"Blast!" Morton barked into his communicator.

The mobile units throbbed; and then pure atomic flame ravened out and poured upon the hard metal of the door. The first molten droplet rolled reluctantly, not down, but up the door. The second was more normal. It followed a shaky downward course. The third rolled sideways—for this was pure force, not subject to gravitation. Other drops followed until a dozen streams trickled sedately yet unevenly in every direction —streams of hellish, sparkling fire, bright as fairy gems, alive with the coruscating fury of atoms suddenly tor-

tured, and running blindly, crazy with pain.

The minutes ate at time like a slow acid. At last Morton asked huskily:

"Selenski?"

"Nothing yet, commander."

Morton half whispered: "But he must be doing something. He can't be just waiting in there like a cornered rat. Selenski?"

"Nothing, commander."

Seven minutes, eight minutes, then twelve.

"Commander!" It was Selenski's voice, taut. "He's got the electric dynamo running."

Morton drew a deep breath, and heard one of his men say:

"That's funny. We can't get any deeper. Boss, take a look at this."

Morton looked. The little scintillating streams had frozen rigid. The ferocity of the disintegrators vented in vain against metal grown suddenly invulnerable.

Morton sighed. "Our test is over. Leave two men guarding every corridor. The others come up to the control room."

HE SEATED himself a few minutes later before the massive control keyboard. "So far as I'm concerned the test was a success. We know that of all the machines in the engine room, the most important to the monster was the electric dynamo. He must have worked in a frenzy of terror while we were at the doors."

"Of course, it's easy to see what he did," Pennons said. "Once he had the power he increased the electronic tensions of the door to their ultimate."

"The main thing is this," Smith chimed in. "He works with vibrations only so far as his special powers are concerned, and the energy must come from outside himself. Atomic energy in its pure form, not being vibration, he can't handle any differently than we can."

Kent said glumly: "The main point in my opinion is that he stopped us cold. What's the good of knowing that his control over vibrations did it? If we can't break through those doors with our atomic disintegrators, we're finished."

Morton shook his head. "Not finished—but we'll have to do some planning. First, though, I'll start these engines. It'll be harder for him to get control of them when they're running."

He pulled the master switch back into place with a jerk. There was a hum, as scores of machines leaped into violent life in the engine room a hundred feet below. The noises sank to a steady vibration of throbbing power.

Three hours later, Morton paced up and down before the men gathered in the salon. His dark hair was uncombed; the space pallor of his strong face emphasized rather than detracted from the outthrust aggressiveness of his jaw. When he spoke, his deep voice was crisp to the point of sharpness:

"To make sure that our plans are fully co-ordinated, I'm going to ask each expert in turn to outline his part in the overpowering of this creature. Pennons first!"

Pennons stood up briskly. He was not a big man, Morton thought, yet he looked big, perhaps because of his air of authority. This man knew engines, and the history of engines. Morton had heard him trace a machine through its evolution from a simple toy to the highly complicated modern instrument. He had studied machine development on a hundred planets; and there was literally nothing fundamental that he didn't know about mechanics. It was almost weird to hear Pennons, who could have spoken for a thousand hours and still only have touched upon his subject, say with absurd brevity:

"We've set up a relay in the control

room to start and stop every engine rhythmically. The trip lever will work a hundred times a second, and the effect will be to create vibrations of every description. There is just a possibility that one or more of the machines will burst, on the principle of soldiers crossing a bridge in step—you've heard that old story, no doubt—but in my opinion there is no real danger of a break of that tough metal. The main purpose is simply to interfere with the interference of the creature, and smash through the doors."

"Gourlay next!" barked Morton.

Gourlay climbed lazily to his feet. He looked sleepy, as if he was somewhat bored by the whole proceedings, yet Morton knew he loved people to think him lazy, a good-for-nothing slouch, who spent his days in slumber and his nights catching forty winks. His title was chief communication engineer, but his knowledge extended to every vibration field; and he was probably, with the possible exception of Kent, the fastest thinker on the ship. His voice drawled out, and—Morton noted—the very deliberate assurance of it had a soothing effect on the men—anxious faces relaxed, bodies leaned back more restfully:

"Once inside," Gourlay said, "we've rigged up vibration screens of pure force that should stop nearly everything he's got on the ball. They work on the principle of reflection, so that everything he sends will be reflected back to him. In addition, we've got plenty of spare electric energy that we'll just feed him from mobile copper cups. There must be a limit to his capacity for handling power with those insulated nerves of his."

"Selenski!" called Morton.

The chief pilot was already standing, as if he had anticipated Morton's call. And that, Morton reflected, was the man. His nerves had that rocklike steadiness which is the first requirement of the master controller of a great ship's movements; yet that very steadiness seemed to rest on dynamite ready to explode at its owner's volition. He was not a man of great learning, but he "reacted" to stimuli so fast that he always seemed to be anticipating.

"The impression I've received of the plan is that it must be cumulative. Just when the creature thinks that he can't stand any more, another thing happens to add to his trouble and confusion. When the uproar's at its height, I'm supposed to cut in the anti-accelerators. The commander thinks with Gunlie Lester that these creatures will know nothing about anti-acceleration. It's a development, pure and simple, of the science of interstellar flight, and couldn't have been developed in any other way. We think when the creature feels the first effects of the anti-acceleration—you all remember the caved-in feeling you had the first month—it won't know what to think or do."

"KORITA next."

"I can only offer you encouragement," said the archeologist, "on the basis of my theory that the monster has all the characteristics of a criminal of the early ages of any civilization, complicated by an apparent reversion to primitiveness. The suggestion has been made by Smith that his knowledge of science is puzzling, and could only mean that we are dealing with an actual inhabitant, not a descendant of the inhabitants of the dead city we visited. This would ascribe a virtual immortality to our enemy, a possibility which is borne out by his ability to breathe both oxygen and chlorine—or neither—but even that makes no difference. He comes from a certain age in his civilization; and he has sunk so low that his ideas are mostly memories of that age.

"In spite of all the powers of his body, he lost his head in the elevator the first morning, until he remembered. He placed himself in such a position that

he was forced to reveal his special powers against vibrations. He bungled the mass murders a few hours ago. In fact, his whole record is one of the low cunning of the primitive, egotistical mind which has little or no conception of the vast organization with which it is confronted.

"He is like the ancient German soldier who felt superior to the elderly Roman scholar, yet the latter was part of a mighty civilization of which the Germans of that day stood in awe.

"You may suggest that the sack of Rome by the Germans in later years defeats my argument; however, modern historians agree that the 'sack' was an historical accident, and not history in the true sense of the word. The movement of the 'Sea-peoples' which set in against the Egyptian civilization from 1400 B. C. succeeded only as regards the Cretan island-realm—their mighty expeditions against the Libyan and Phœnician coasts, with the accompaniment of viking fleets, failed as those of the Huns failed against the Chinese Empire. Rome would have been abandoned in any event. Ancient, glorious Samarra was desolate by the tenth century; Pataliputra, Asoka's great capital, was an immense and completely uninhabited waste of houses when the Chinese traveler Hsinan-tang visited it about A. D. 635.

"We have, then, a primitive, and that primitive is now far out in space, completely outside of his natural habitat. I say, let's go in and win."

One of the men grumbled, as Korita finished: "You can talk about the sack of Rome being an accident, and about this fellow being a primitive, but the facts are facts. It looks to me as if Rome is about to fall again; and it won't be no primitive that did it, either. This guy's got plenty of what it takes."

Morton smiled grimly at the man, a member of the crew. "We'll see about that—right now!"

IN THE blazing brilliance of the gigantic machine shop, Coeurl slaved. The forty-foot, cigar-shaped spaceship was nearly finished. With a grunt of effort, he completed the laborious installation of the drive engines, and paused to survey his craft.

Its interior, visible through the one aperture in the outer wall, was pitifully small. There was literally room for nothing but the engines—and a narrow space for himself.

He plunged frantically back to work as he heard the approach of the men, and the sudden change in the tempest-like thunder of the engines—a rhythmical off-and-on hum, shriller in tone, sharper, more nerve-racking than the deep-throated, steady throb that had preceded it. Suddenly, there were the atomic disintegrators again at the massive outer doors.

He fought them off, but never wavered from his task. Every mighty muscle of his powerful body strained as he carried great loads of tools, machines and instruments, and dumped them into the bottom of his makeshift ship. There was no time to fit anything into place, no time for anything—no time—no time.

The thought pounded at his reason. He felt strangely weary for the first time in his long and vigorous existence. With a last, tortured heave, he jerked the gigantic sheet of metal into the gaping aperture of the ship—and stood there for a terrible minute, balancing it precariously.

He knew the doors were going down. Half a dozen disintegators concentrating on one point were irresistibly, though slowly, eating away the remaining inches. With a gasp, he released his mind from the doors and concentrated every ounce of his mind on the yard-thick outer wall, toward which the blunt nose of his ship was pointing.

His body cringed from the surging power that flowed from the electric dy-

namo through his ear tendrils into that resisting wall. The whole inside of him felt on fire, and he knew that he was dangerously close to carrying his ultimate load.

And still he stood there, shuddering with the awful pain, holding the unfastened metal plate with hard-clenched tentacles. His massive head pointed as in dread fascination at that bitterly hard wall.

He heard one of the engine-room doors crash inward. Men shouted; disintegrators rolled forward, their raging power unchecked. Coeurl heard the floor of the engine room hiss in protest, as those beams of atomic energy tore everything in their path to bits. The machines rolled closer; cautious footsteps sounded behind them. In a minute they would be at the flimsy doors separating the engine room from the machine shop.

Suddenly, Coeurl was satisfied. With a snarl of hate, a vindictive glow of feral eyes, he ducked into his little craft, and pulled the metal plate down into place as if it was a hatchway.

His ear tendrils hummed, as he softened the edges of the surrounding metal. In an instant, the plate was more than welded—it was part of his ship, a seamless, rivetless part of a whole that was solid opaque metal except for two transparent areas, one in the front, one in the rear.

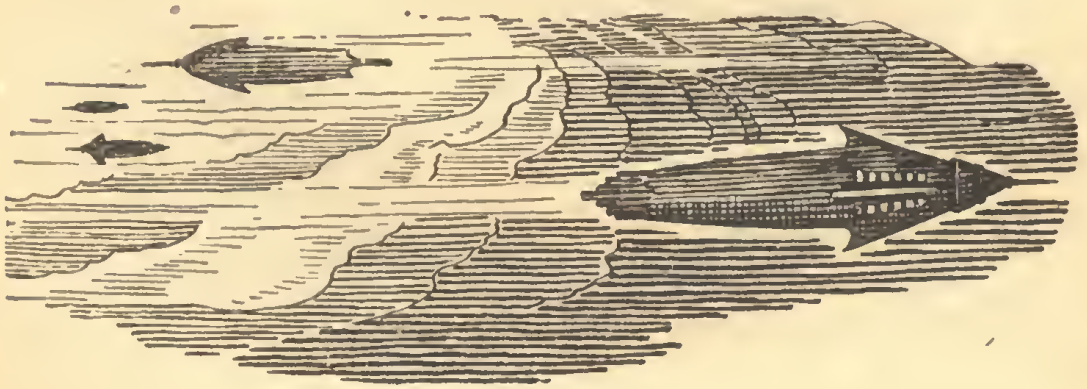
His tentacle embraced the power drive with almost sensuous tenderness. There was a forward surge of his fragile machine, straight at the great outer wall of the machine shops. The nose of the forty-foot craft touched—and the wall dissolved in a glittering shower of dust.

Coeurl felt the barest retarding movement; and then he kicked the nose of the machine out into the cold of space, twisted it about, and headed back in the direction from which the big ship had been coming all these hours.

Men in space armor stood in the jagged hole that yawned in the lower reaches of the gigantic globe. The men and the great ship grew smaller. Then the men were gone; and there was only the ship with its blaze of a thousand blurring portholes. The ball shrank incredibly, too small now for individual portholes to be visible.

Almost straight ahead, Coeurl saw a tiny, dim, reddish ball—his own sun, he realized. He headed toward it at full speed. There were caves where he could hide and with other coeurls build secretly a spaceship in which they could reach other planets safely—now that he knew how.

His body ached from the agony of acceleration, yet he dared not let up for a single instant. He glanced back, half in terror. The globe was still there, a tiny dot of light in the immense blackness of space. Suddenly it twinkled and was gone.



For a brief moment, he had the empty, frightened impression that just before it disappeared, it moved. But he could see nothing. He could not escape the belief that they had shut off all their lights, and were sneaking up on him in the darkness. Worried and uncertain, he looked through the forward transparent plate.

A TREMOR of dismay shot through him. The dim red sun toward which he was heading was not growing larger. *It was becoming smaller* by the instant, And it grew visibly tinier during the next five minutes, became a pale-red dot in the sky—and vanished like the ship.

Fear came then, a blinding surge of it, that swept through his being and left him chilled with the sense of the unknown. For minutes, he stared frantically into the space ahead, searching for some landmark. But only the remote stars glimmered there, unwinking points against a velvet background of unfathomable distance.

Wait! One of the points was growing larger. With every muscle and nerve tensed, Coeurl watched the point becoming a dot, a round ball of light—red light. Bigger, bigger, it grew. Suddenly, the red light shimmered and turned white—and there, before him, was the great globe of the spaceship, lights glaring from every porthole, the very ship which a few minutes before he had watched vanish behind him.

Something happened to Coeurl in that moment. His brain was spinning like a flywheel, faster, faster, more incoherently. Suddenly, the wheel flew apart into a million aching fragments. His eyes almost started from their sockets as, like a maddened animal, he raged in his small quarters.

His tentacles clutched at precious instruments and flung them insensately; his paws smashed in fury at the very walls of his ship. Finally, in a brief flash of sanity, he knew that he couldn't face the inevitable fire of atomic disintegrators.

It was a simple thing to create the violent disorganization that freed every drop of id from his vital organs.

They found him lying dead in a little pool of phosphorus.

"Poor pussy," said Morton. "I wonder what he thought when he saw us appear ahead of him, after his own sun disappeared. Knowing nothing of anti-accelerators, he couldn't know that we could stop short in space, whereas it would take him more than three hours to decelerate; and in the meantime he'd be drawing farther and farther away from where he wanted to go. He couldn't know that by stopping, we flashed past him at millions of miles a second. Of course, he didn't have a chance once he left our ship. The whole world must have seemed topsy-turvy."

"Never mind the sympathy," he heard Kent say behind him. "We've got a job—to kill every cat in that miserable world."

Korita murmured softly: "That should be simple. They are but primitives; and we have merely to sit down, and they will come to us, cunningly expecting to delude us."

Smith snapped: "You fellows make me sick! Pussy was the toughest nut we ever had to crack. He had everything he needed to defeat us—"

Morton smiled as Korita interrupted blandly: "Exactly, my dear Smith, except that he reacted according to the biological impulses of his type. His defeat was already foreshadowed when we unerringly analyzed him as a criminal from a certain era of his civilization.

"It was history, honorable Mr. Smith, our knowledge of history that defeated him," said the Japanese archeologist, reverting to the ancient politeness of his race.

IN TIMES TO COME

This prophecy department seems somewhat less accurate than the Editor's Page, which is not supposed to be particularly prophetic. Here, we don't alwoys accurately predict next month's stories, while the Editor's Page accurately predicted last summer that the discoverer of atomic power would be found to be a man then living and working.

True, Lester del Rey did not appear in this issue, as promised. That's because his novelette, "The Luck of Ignatz," is appearing in next month's issue os the cover story. The cover, incidentally, should please some few of you. It's being done by Virgil Finlay, and illustrates the engine room of a spaceship. Gentlemen, we try to please!

Dr. E. E. Smith sent a progress report the other day. About a week from the day I'm writing this, I should get the "Gray Lensman" manuscript. He says he's trying to cut it down to 100,000 words. That would indicate that it is not a particularly abridged edition.

Along with del Rey's "Luck of Ignatz" will be another P. Schuyler Miller novelette—"Pleasure Trove." Miller seems to have really gone back to the writing business.

Two new authors will appeor, too. Frederick Engelhardt, new only to science-fiction, presents a serial with a type of narrative form new to science-fiction also. An artillery man himself, Engelhardt has written a two-part novel of revolt on Venus in the logical manner: straight military narrative. And Lee Gregor, a graduate fan, has done a more-thon-average job of writing on a short story. Gregor will, I feel sure, appear more than once in the future.

In fact, considering the percentage of Astounding's new authors who have proven themselves to be first-rank writers, it is more than an even probobility thot these two will also rise.

The Editor.

THE ANALYTICAL LABORATORY

The general tone of the letters received this month showed that the places in the scoring were hotly, closely contested, that the whole May issue was well liked. That, in such a bottle, John Berryman's "Special Flight" won first place means, I think, that Berrymon has estoblished himself as another new top-rank writer.

L. Sprague de Camp's ortiele has, again, forced its woy into the Laboratory. Normally I do not rate the articles with the stories because they suffer under a heavy handicap that makes fair rating hard—something like trying to determine whether this apple is a better apple than this oronge is an orange. Articles seldom have heroes, and, when they do, you olready know the answer to the hero's problem, which tends to make the hero seem slightly thick-witted. Mr. de Camp has a habit of breoking down that rule. The ratings came out:

1.	Special Flight	John Berryman
2.	Design for Life (article)	L. Sprague de Camp
3.	The Day is Done	Lester del Rey
4.	Employment	Lymon R. Lyon
5.	Melody and Moons	Kent Casey

The Editor.

TRENDS

By ISAAC ASIMOV

TRENDS

A new author presents a new type of obstacle that may face the first rocket-ship's inventor—the minds of men did not always run as they do now.

By Isaac Asimov

Illustrated by Orban

JOHN HARMAN was sitting at his desk, brooding, when I entered the office that day. It had become a common sight, by then, to see him staring out at the Hudson, head in hand, a scowl contorting his face—all too common. It seemed unfair for the little bantam to be eating his heart out like that day after day, when by rights he should have been receiving the praise and adulation of the world.

I flopped down into a chair. "Did you see the editorial in today's *Clarion*, boss?"

He turned weary, bloodshot eyes toward me. "No, I haven't. What do they say? Are they calling the vengeance of God down upon me again?" His voice dripped with bitter sarcasm.

"They're going a little farther *now*, boss," I answered. "Listen to this:

> "Tomorrow is the day of John Harman's attempt at profaning the heavens. Tomorrow, in defiance of world opinion and world conscience, this man will defy God.
>
> "It is not given to man to go whereso-ever ambition and desire lead him. There are things forever denied him, and aspiring to the stars is one of these. Like Eve, John Harman wishes to eat of the forbidden fruit, and like Eve he will suffer due punishment therefor.
>
> "But it is not enough, this mere talk. If we allow him thus to brook the vengeance of God, the trespass is mankind's and not Harman's alone. In allowing him to carry out his evil designs, we make ourselves accessory to the crime, and Divine vengeance will fall on all alike.
>
> "It is, therefore, essential that immediate steps be taken to prevent Harman from taking off in his so-called rocketship tomorrow. The government in refusing to take such steps may force violent action. If it will make no move to confiscate the rocketship, or to imprison Harman, our enraged citizenry may have to take matters into their own hands—"

Harman sprang from his seat in a rage and, snatching the paper from my hands, threw it into the corner furiously. "It's an open call to a lynching," he raved. "Look at this!"

He cast five or six envelopes in my direction. One glance sufficed to tell what they were.

"More death threats?" I asked.

"Yes, exactly that. I've had to arrange for another increase in the police patrol outside the building and for a motorcycle police escort when I cross the river to the testing ground tomorrow."

He marched up and down the room with agitated stride. "I don't know what to do, Clifford. I've worked on the *Prometheus* almost ten years. I've slaved, spent a fortune of money, given up all that makes life worth while—and for what? So that a bunch of fool revivalists can whip up public sentiment against me until my very life isn't safe."

"You're in advance of the times,

boss." I shrugged my shoulders in a resigned gesture which made him whirl upon me in a fury.

"What do you mean 'in advance of the times'? This is 1973. The world has been ready for space travel for half a century now. Fifty years ago, people were talking, dreaming of the day when man could free himself of Earth and plumb the depths of space. For fifty years, science has inched toward this goal, and now . . . now I finally have it, and behold! you say the world is not ready for me."

"The '20s and '30s were years of anarchy, decadence, and misrule, if you remember your history," I reminded him gently. "You cannot accept them as criteria."

"I know, I know. You're going to tell me of the First War of 1914, and the Second of 1940. It's an old story to me; my father fought in the Second and my grandfather in the First. Nevertheless, those were the days when science *flourished*. Men were not afraid then; somehow they dreamed and dared. There was no such thing as conservatism when it came to matters mechanical and scientific. No theory was too radical to advance, no discovery too revolutionary to publish. Today, dry rot has seized the world when a great vision, such as space travel, is hailed as 'defiance of God.'"

His head sank slowly down, and he turned away to hide his trembling lips and the tears in his eyes. Then he suddenly straightened again, eyes blazing: "But I'll show them. I'm going through with it, in spite of hell, Heaven and Earth. I've put too much into it to quit now."

"Take it easy, boss," I advised. "This isn't going to do you any good tomorrow, when you get into that ship. Your chances of coming out alive aren't too good now, so what will they be if you start out worn to pieces with excitement and worry?"

"You're right. Let's not think of it any more. Where's Shelton?"

"Over at the Institute arranging for the special photographic plates to be sent us."

"He's been gone a long time, hasn't he?"

"Not especially; but listen, boss, there's something wrong with him. I don't like him."

"Poppycock! He's been with me two years, and I have no complaints."

"All right." I spread my hands in resignation. "If you won't listen to me, you won't. Just the same I caught him reading one of those infernal pamphlets Otis Eldredge puts out. You know the kind: 'Beware, O mankind, for judgment draws near. Punishment for your sins is at hand. Repent and be saved.' And all the rest of the time-honored junk."

Harman snorted in disgust. "Cheap tub-thumping revivalist! I suppose the world will never outgrow his type—not while sufficient morons exist. Still you can't condemn Shelton just because he reads it. I've read them myself on occasion."

"He *says* he picked it up on the sidewalk and read it in 'idle curiosity,' but I'm pretty sure I saw him take it out of his wallet. Besides, he goes to church every Sunday."

"Is *that* a crime? Everyone does, nowadays!"

"Yes, but not to the Twentieth Century Evangelical Society. That's Eldredge's."

That jolted Harman. Evidently, it was the first he had heard of it. "Say, that *is* something, isn't it? We'll have to keep an eye on him, then."

But after that, things started to happen, and we forgot all about Shelton—until it was too late.

THERE was nothing much left to do that last day before the test, and I wandered into the next room, where I

went over Harman's final report to the Institute. It was my job to correct any errors or mistakes that crept in, but I'm afraid I wasn't very thorough. To tell the truth, I couldn't concentrate. Every few minutes, I'd fall into a brown study.

It seemed queer, all this fuss over space travel. When Harman had first announced the approaching perfection of the *Prometheus*, some six months before, scientific circles had been jubilant. Of course, they were cautious in their statements and qualified everything they said, but there was real enthusiasm.

However, the masses didn't take it that way. It seems strange, perhaps, to you of the twenty-first century, but perhaps we should have expected it in those days of '73. People weren't very progressive then. For years there had been a swing toward religion, and when the churches came out unanimously against Harman's rocket—well, there you were.

At first, the opposition confined itself *to* the churches and we thought it might play itself out. But it didn't. The papers got hold of it, and literally spread the gospel. Poor Harman became an anathema to the world in a remarkably short time, and then his troubles began.

He received death threats, and warnings of divine vengeance every day. He couldn't walk the streets in safety. Dozens of sects, to none of which he belonged—he was one of the very rare free-thinkers of the day, which was another count against him—excommunicated him and placed him under special interdict. And, worst of all, Otis Eldredge and his Evangelical Society began stirring up the populace.

Eldredge was a queer character—one of those geniuses, in their way, that arise every so often.. Gifted with a golden tongue and a sulphurous vocabulary, he could fairly hypnotize a crowd. Twenty thousand people were so much putty in his hands, could he only bring them within earshot. And for four months, he thundered against Harman; for four months, a pouring stream of denunciation rolled forth in oratorical frenzy. And for four months, the temper of the world rose.

But Harman was not to be daunted. In his tiny, five-foot-two body, he had enough spirit for five six-footers. The more the wolves howled, the firmer he held his ground. With almost divine —his enemies said, diabolical—obstinacy, he refused to yield an inch. Yet his outward firmness was to me, who knew him, but an imperfect concealment of the great sorrow and bitter disappointment within.

The ring of the doorbell interrupted my thoughts at that point and brought me to my feet in surprise. Visitors were very few those days.

I looked out the window and saw a tall, portly figure talking with Police Sergeant Cassidy. I recognized him at once as Howard Winstead, head of the Institute. Harman was hurrying out to greet him, and after a short exchange of phrases, the two entered the office. I followed them in, being rather curious as to what could have brought Winstead, who was more politician than scientist, here.

WINSTEAD didn't seem very comfortable, at first; not his usual suave self. He avoided Harman's eyes in an embarrassed manner and mumbled a few conventionalities concerning the weather. Then he came to the point with direct, undiplomatic bluntness.

"John," he said, "how about postponing the trial for a time?"

"You really mean abandoning it altogether, don't you? Well, I won't, and that's final."

Winstead lifted his hand. "Wait now, John, don't get excited. Let me state my case. I know the Institute agreed to give you a free hand, and I know that you paid at least half the expenses out of your own pocket, but—

you can't go through with it."

"Oh, can't I, though?" Harman snorted derisively.

"Now listen, John, you know your science, but you don't know your human nature, and I do. This is not the world of the 'Mad Decades,' whether you realize it or not. There have been profound changes since 1940." He swung into what was evidently a carefully prepared speech.

"After the First World War, you know, the world as a whole swung away from religion and toward freedom from convention. People were disgusted and disillusioned, cynical and sophisticated. Eldredge calls them 'wicked and sinful.' In spite of that, science flourished—some say it always fares best in such an unconventional period. From *its* standpoint it was a 'Golden Age.'

"However, you know the political and economic history of the period. It was a time of political chaos and international anarchy; a suicidal, brainless, insane period—and it culminated in the Second World War. And just as the First War led to a period of sophistication, so the Second initiated a return to religion.

"People were disgusted with the 'Mad Decades.' They had had enough of it, and feared, beyond all else, a return to it. To remove that possibility, they put the ways of those decades behind them. Their motives, you see, were understandable and laudable. All the freedom, all the sophistication, all the lack of convention were gone—swept away clean. We are living now in a second Victorian age; and naturally so, because human history goes by swings of the pendulum and this is the swing toward religion and convention.

"One thing only is left over since those days of half a century ago. That one thing is the respect of humanity for science. We have prohibition; smoking for women is outlawed; cosmetics are forbidden; low dresses and short skirts are unheard of; divorce is frowned upon. But science has not been confined—*as yet*.

"It behooves science, then, to be circumspect, to refrain from arousing the people. It will be very easy to make them believe—and Otis Eldredge has come perilously close to doing it in some of his speeches—that it was science that brought about the horrors of the Second World War. Science outstripped culture, they will say, technology outstripped sociology, and it was that unbalance that came so near to destroying the world. Somehow, I am inclined to believe they are not so far wrong, at that.

"But do you know what would happen, if it ever *did* come to that? Scientific research may be forbidden; or, if they don't go that far, it will certainly be so strictly regulated as to stifle in its own decay. It will be a calamity from which humanity would not recover for a millennium.

"And it is your trial flight that may precipitate all this. You are arousing the public to a stage where it will be difficult to calm them. I warn you, John. The consequences will be on your head."

THERE WAS absolute silence for a moment and then Harman forced a smile. "Come, Howard, you're letting yourself be frightened by shadows on the wall. Are you trying to tell me that it is your serious belief that the world as a whole is ready to plunge into a second Dark Ages? After all, the intelligent men are on the side of science, aren't they?"

"If they are, there aren't many of them left from what I see." Winstead drew a pipe from his pocket and filled it slowly with tobacco as he continued: "Eldredge formed a League of the Righteous two months ago—they call it the L. R.—and it has grown unbelievably. *Twenty million is its membership in the United States alone.* Eldredge

boasts that after the next election Congress will be his; and there seems to be more truth than bluff in that. Already there has been strenuous lobbying in favor of a bill outlawing rocket experiments, and laws of that type have been enacted in Poland, Portugal, and Rumania. Yes, John, we are perilously close to open persecution of science." He was smoking now in rapid, nervous puffs.

"But if I succeed, Howard, if I succeed! What then?"

"Bah! You know the chances for that. Your own estimate gives you only one chance in ten of coming out alive."

"What does that signify? The next experimenter will learn by my mistakes, and the odds will improve. That's the scientific method."

"The mob doesn't know anything about the scientific method; and they don't want to know. Well, what do you say? Will you call it off?"

Harman sprang to his feet, his chair tumbling over with a crash. "Do you know what you ask? Do you want me to give up my life's work, my dream, just like that? Do you think I'm going to sit back and wait for your *dear* public to become benevolent? Do you think they'll change in *my* lifetime?

"Here's my answer: I have an inalienable right to pursue knowledge. Science has an inalienable right to progress and develop without interference. The world, in interfering with me, is wrong; I am right. And it shall go hard, but I *will not* abandon my rights."

Winstead shook his head sorrowfully. "You're wrong, John, when you speak of 'inalienable' rights. What you call a 'right' is merely a *privilege, generally agreed upon.* What society accepts, is right; what it does not, is wrong."

"Would your friend, Eldredge, agree to such a definition of his 'righteousness'?" questioned Harman bitterly.

"No, he would not, but that's irrelevant. Take the case of those African tribes who used to be cannibals. They were brought up as cannibals, have the long tradition of cannibalism, and their society accepts the practice. To *them,* cannibalism is *right,* and why shouldn't it be? So you see how relative the whole notion is, and how inane your conception of 'inalienable' rights to perform experiments is."

"You know, Howard, you missed your calling when you didn't become a lawyer." Harman was really growing angry. "You've been bringing out every moth-eaten argument you can think of. For God's sake, man, are you trying to pretend that it is a crime to refuse to run with the crowd? Do you stand for absolute uniformity, ordinariness, orthodoxy, commonplaceness? Science would die far sooner under the program you outline than under governmental prohibition."

Harman stood up and pointed an accusing finger at the other. "You're betraying science and the tradition of those glorious rebels: Galileo, Darwin, Einstein and their kind. My rocket leaves tomorrow on schedule in spite of you and every other stuffed shirt in the United States. That's that, and I refuse to listen to you any longer. So you can just get out."

The head of the Institute, red in the face, turned to me. "You're my witness, young man, that I warned this obstinate nitwit, this . . . this harebrained fanatic." He spluttered a bit, and then strode out, the picture of fiery indignation.

Harman turned to me when he had gone: "Well, what do *you* think? I suppose you agree with him."

There was only one possible answer and I made it: "You're not paying me to do anything else but follow orders, boss. I'm sticking with you."

Just then Shelton came in and Harman packed us both off to go over the calculations of the orbit of flight for the

umpteenth time, while he himself went off to bed.

THE NEXT DAY, July 15th, dawned in matchless splendor, and Harman, Shelton, and myself were in an almost gay mood as we crossed the Hudson to where the *Prometheus*—surrounded by an adequate police guard—lay in gleaming grandeur.

Around it, roped off at an apparently safe distance, rolled a crowd of gigantic proportions. Most of them were hostile, raucously so. In fact, for one fleeting moment, as our motorcycle police escort parted the crowds for us, the shouts and imprecations that reached our ears almost convinced me that we should have listened to Winstead.

But Harman paid no attention to them at all, after one supercilious sneer at a shout of: "There goes John Harman, son of Belial." Calmly, he directed us about our task of inspection. I tested the foot-thick outer walls and the air locks for leaks, then made sure the air purifier worked. Shelton checked up on the repellent screen and the fuel tanks. Finally, Harman tried on the clumsy spacesuit, found it suitable, and announced himself ready.

The crowd stirred. Upon a hastily erected platform of wooden planks piled in confusion by some in the mob, there rose up a striking figure. Tall and lean; with thin, ascetic countenance; deep-set, burning eyes, peering and half closed; a thick, white mane crowning all—it was Otis Eldredge. The crowd recognized him at once and many cheered. Enthusiasm waxed and soon the entire turbulent mass of people shouted themselves hoarse over him.

He raised a hand for silence, turned to Harman, who regarded him with surprise and distaste, and pointed a long, bony finger at him:

"John Harman, son of the devil, spawn of Satan, you are here for an evil purpose. You are about to set out upon a blasphemous attempt to pierce the veil beyond which man is forbidden to go. You are tasting of the forbidden fruit of Eden and beware that you taste not of the fruits of sin."

The crowd cheered him to the echo and he continued: "The finger of God is upon you, John Harman. He shall not allow His works to be defiled. You die today, John Harman." His voice rose in intensity and his last words were uttered in truly prophetlike fervor.

Harman turned away in disdain. In a loud, clear voice, he addressed the police sergeant: "Is there any way, officer, of removing these spectators. The trial flight may be attended by some destruction because of the rocket blasts, and they're crowding too close."

The policeman answered in a crisp, unfriendly tone: "If you're afraid of being mobbed, say so, Mr. Harman. You don't have to worry, though, we'll hold them back. And as for danger—from *that* contraption—" He sniffed loudly in the direction of the *Prometheus,* evoking a torrent of jeers and yells.

Harman said nothing further, but climbed into the ship in silence. And when he did so, a queer sort of stillness fell over the mob; a palpable tension. There was no attempt at rushing the ship, an attempt I had thought inevitable. On the contrary, Otis Eldredge himself shouted to everyone to move back.

"Leave the sinner to his sins," he shouted. "'Vengeance is mine,' saith the Lord."

As the moment approached, Shelton nudged me. "Let's get out of here," he whispered in a strained voice. "Those rocket blasts are poison." Saying this, he broke into a run, beckoning anxiously for me to follow.

We had not yet reached the fringes of the crowd when there was a terrific roar behind me. A wave of heated air swept over me. There was the fright-

ening hiss of some speeding object past my ear, and I was thrown violently to the ground. For a few moments I lay dazed, my ears ringing and my head reeling.

WHEN I staggered drunkenly to my feet again, it was to view a dreadful sight. Evidently, the entire fuel supply of the *Prometheus* had exploded at once, and where it had lain a moment ago there was now only a yawning hole. The ground was strewn with wreckage. The cries of the hurt were heartrending and the mangled bodies—but I won't try to describe those.

A weak groan at my feet attracted my attention. One look, and I gasped in horror, for it was Shelton, the back of his head a bloody mass.

"I did it." His voice was hoarse and triumphant but withal so low that I could scarcely hear it. "I did it. I broke open the liquid-oxygen compartments and when the spark went through the acetylide mixture the whole cursed thing exploded." He gasped a bit and tried to move but failed. "A piece of wreckage must have hit me, but I don't care. I'll die knowing that—"

His voice was nothing more than a rasping rattle, and on his face was the ecstatic look of a martyr. He died then, and I could not find it in my heart to condemn him.

It was then I first thought of Harman. Ambulances from Manhattan and from Jersey City were on the scene, and one had sped to a wooden patch some five hundred yards distant where, caught in the treetops, lay a splintered fragment of the *Prometheus'* forward compartment. I limped there as fast as I could, but they had dragged out Harman and clanged away long before I could reach them.

After that, I didn't stay. The disorganized crowd had no thought but for the dead and wounded *now,* but when they recovered, and bent their thoughts to revenge, my life would not be worth a straw. I followed the dictates of the better part of valor and quietly disappeared.

The next week was a hectic one for me. During that time, I lay in hiding at the home of a friend, for it would have been more than my life was worth to allow myself to be seen and recognized. Harman, himself, lay in a Jersey City hospital, with nothing more than superficial cuts and bruises—thanks to the backward force of the explosion and the saving clump of trees which cushioned the fall of the *Prometheus.* It was on him that the brunt of the world's wrath fell.

New York, and the rest of the world also, just about went crazy. Every last paper in the city came out with gigantic headlines, "28 Killed, 73 Wounded—the Price of Sin," printed in blood-red letters. The editorials howled for Harman's life, demanding he be arrested and tried for first-degree murder.

The dreaded cry of "Lynch him!" was raised throughout the five boroughs, and milling thousands crossed the river and converged on Jersey City. At their head was Otis Eldredge, both legs in splints, addressing the crowd from an open automobile as they marched. It was a veritable army.

Mayor Carson of Jersey City called out every available policeman and phoned frantically to Trenton for the State militia. New York clamped down on every bridge and tunnel leaving the city—but not till after many thousands had left.

There were pitched battles on the Jersey coast that sixteenth of July. The vastly outnumbered police clubbed indiscriminately but were gradually pushed back and back. Mounties rode down upon the mob relentlessly but were swallowed up and pulled down by sheer force of numbers. Not until tear gas was used, did the crowd halt—and even then they did not retreat.

The next day, martial law was declared, and the State militia entered Jersey City. That was the end for the lynchers. Eldredge was called to confer with the mayor, and after the conference ordered his followers to disperse.

In a statement to the newspapers, Mayor Carson said: "John Harman must needs suffer for his crime, but it is essential that he do so legally. Justice must take its course, and the State of New Jersey will take all necessary measures."

BY THE END of the week, normality of a sort had returned and Harman slipped out of the public spotlight. Two more weeks and there was scarcely a word about him in the newspapers, excepting such casual references to him in the discussion of the new Zittman antirocketry bill that had just passed both houses of Congress by unanimous votes.

Yet he remained in the hospital still. No legal action had been taken against him, but it began to appear that a sort of indefinite imprisonment "for his own protection" might be his eventual fate. Therefore, I bestirred myself to action.

Temple Hospital is situated in a lonely and outlying district of Jersey City, and on a dark, moonless night I experienced no difficulty at all in invading the grounds unobserved. With a facility that surprised me, I sneaked in through a basement window, slugged a sleepy interne into insensibility and proceeded to Room 15E, which was listed in the books as Harman's.

"Who's there?" Harman's surprised shout was music in my ears.

"Sh! Quiet! It's I, Cliff McKenny."

"You! What are you doing here?"

"Trying to get you out. If I don't, you're liable to stay here the rest of your life. Come on, let's go."

I was hustling him into his clothes while we were speaking, and in no time at all we were sneaking down the corridor. We were out safely and into my waiting car before Harman collected his scattered wits sufficiently to begin asking questions.

"What's happened since that day?" was the first question. "I don't remember a thing after starting the rocket blasts until I woke up in the hospital."

"Didn't they tell you anything?"

"Not a damn thing," he swore. "I asked until I was hoarse."

So I told him the whole story from the explosion on. His eyes were wide with shocked surprise when I told of the dead and wounded, and filled with wild rage when he heard of Shelton's treachery. The story of the riots and attempted lynching evoked a muffled curse from between set lips.

"Of course, the papers howled 'murder,'" I concluded, "but they couldn't pin *that* on you. They tried manslaughter, but there were too many eyewitnesses that had heard your request for the removal of the crowd and the police sergeant's absolute refusal to do so. That, of course, absolved you from all blame. The police sergeant himself died in the explosion, and they couldn't make him the goat.

"Still, with Eldredge yelling for your hide, you're never safe. It would be best to leave while able."

Harman nodded his head in agreement. "Eldredge survived the explosion, did he?"

"Yes, worse luck. He broke both legs, but it takes more than that to shut his mouth."

Another week had passed before I reached our future haven—my uncle's farm in Minnesota. There, in a lonely and out-of-the-way rural community, we stayed while the hullabaloo over Harman's disappearance gradually died down and the perfunctory search for us faded away. The search, by the way,

was short indeed, for the authorities seemed more relieved than concerned over the disappearance.

PEACE AND QUIET did wonders with Harman. In six months he seemed a new man—quite ready to consider a second attempt at space travel. Not all the misfortunes in the world could stop him, it seemed, once he had his heart set on something.

"My mistake the first time," he told me one winter's day, "lay in announcing the experiment. I should have taken the temper of the people into account, as Winstead said. This time, however"—he rubbed his hands and gazed thoughtfully into the distance—"I'll steal a march on them. The experiment will be performed in secrecy—absolute secrecy."

I laughed grimly. "It would have to be. Do you know that all future experiments in rocketry, even entirely theoretical research, is a crime punishable by death?"

"Are you afraid, then?"

"Of course not, boss. I'm merely stating a fact. And here's another plain fact. We two can't build a ship all by ourselves, you know."

"I've thought of that and figured a way out, Cliff. What's more, I can take care of the money angle, too. You'll have to do some traveling, though.

"First, you'll have to go to Chicago and look up the firm of Roberts & Scranton and withdraw everything that's left of my father's inheritance, which," he added in a rueful aside, "is more than half gone on the first ship. Then, locate as many of the old crowd as you can: Harry Jenkins, Joe O'Brien, Neil Stanton—all of them. And get back as quickly as you can. I am tired of delay."

Two days later, I left for Chicago. Obtaining my uncle's consent to the entire business was a simple affair. "Might as well be strung up for a herd of sheep as for a lamb," he grunted, "so go ahead. I'm in enough of a mess now and can afford a bit more, I guess."

It took quite a bit of traveling and even more smooth talk and persuasion before I managed to get four men to come: the three mentioned by Harman and one other, a Saul Simonoff. With that skeleton force and with the half million still left Harman out of the reputed millions left him by his father, we began work.

The building of the *New Prometheus* is a story in itself—a long story of five years of discouragement and insecurity. Little by little, buying girders in Chicago, beryl-steel plates in New York, a vanadium cell in San Francisco, miscellaneous items in scattered corners of the nation, we constructed the sister ship to the ill-fated *Prometheus*..

The difficulties in the way were all but insuperable. To prevent drawing suspicion down upon us, we had to spread our purchases over periods of time, and to see to it, as well, that the orders were made out to various places. For this we required the co-operation of various friends, who, to be sure, did not know at the time for exactly what purpose the purchases were being used.

We had to synthesize our own fuel, ten tons of it, and that was perhaps the hardest job of all; certainly it took the most time. And finally, as Harman's money dwindled, we came up against our biggest problem—the necessity of economizing. From the beginning we had known that we could never make the *New Prometheus* as large or as elaborate as the first ship had been, but it soon developed that we would have to reduce its equipment to a point perilously close to the danger line. The repulsive screen was barely satisfactory and all attemps at radio communication were perforce abandoned.

And as we labored through the years,

there in the backwoods of northern Minnesota, the world moved on, and Winstead's prophecies proved to have hit amazingly near the mark.

THE EVENTS of those five years—from 1973 to 1978—are well known to the schoolboys of today, the period being the climax of what we now call the "Neo-Victorian Age." The happenings of those years seem well-nigh unbelievable as we look back upon them now.

The outlawing of all research on space travel came in the very beginning, but was a bare start compared to the anti-scientific measures taken in the ensuing

years. The next congressional elections, those of 1974, resulted in a Congress in which Eldredge controlled the House and held the balance of power in the Senate.

Hence, no time was lost. At the first session of the ninety-third Congress, the famous Stonely-Carter bill was passed. It established the Federal Scientific Research Investigatory Bureau—the FSRIB—which was given full power to pass on the legality of all research in the country. Every laboratory, industrial or scholastic, was required to file information, in advance, on all projected research before this new bureau, which could, and did, ban absolutely all such as it disapproved of.

The inevitable appeal to the supreme court came on November 9, 1974, in the case of Westly vs. Simmons, in which Joseph Westly of Stanford upheld his right to continue his investigations on atomic power on the grounds that the Stonely-Carter act was unconstitutional.

How we five, isolated amid the snowdrifts of the Middle West, followed that case! We had all the Minneapolis and St. Paul papers sent to us—always reaching us two days late—and devoured every word of print concerning it. For the two months of suspense work ceased entirely on the *New Prometheus.*

It was rumored at first that the court would declare the act unconstitutional, and monster parades were held in every large town against this eventuality. The League of the Righteous brought its powerful influence to bear—and even the supreme court submitted. It was five to four for constitutionality. *Science strangled by the vote of one man.*

And it was strangled beyond a doubt. The members of the bureau were Eldredge men, heart and soul, and nothing that would not have immediate industrial use was passed.

"Science has gone too far," said Eldredge in a famous speech at about that time. "We must halt it indefinitely, and allow the world to catch up. Only through that and trust in God may we hope to achieve universal and permanent prosperity."

But this was one of Eldredge's last statements. He had never fully recovered from the broken legs he received that fateful day in July of '73, and his strenuous life since then strained his constitution past the breaking point. On February 2, 1976, he passed away amid a burst of mourning unequaled since Lincoln's assassination.

His death had no immediate effect on the course of events. The rules of the FSRIB grew, in fact, in stringency as the years passed. So starved and choked did science become, that once more colleges found themselves forced to reinstate philosophy and the classics as the chief studies—and at that the student body fell to the lowest point since the beginning of the twentieth century.

These conditions prevailed more or less throughout the civilized world, reaching even lower depths in England, and perhaps least depressing in Germany, which was the last to fall under the "Neo-Victorian" influence.

The nadir of science came in the spring of 1978, a bare month before the completion of the *New Prometheus*, with the passing of the "Easter Edict"—it was issued the day before Easter. By it, *all* independent research or experimentation was absolutely forbidden. The FSRIB thereafter reserved the right to allow only such research as it *specifically requested*.

JOHN HARMAN and I stood before the gleaming metal of the *New Prometheus* that Easter Sunday; I in the deepest gloom, and he in an almost jovial mood.

"Well, Clifford, my boy," said he, "the last ton of fuel, a few polishing touches, and I am ready for my second attempt. This time there will be no Sheltons among us." He hummed a hymn. That was all the radio played those days, and even we rebels sang them from sheer frequency of repetition.

I grunted sourly: "It's no use, boss. Ten to one, you end up somewhere in space, and even if you come back, you'll most likely be hung by the neck. We can't win." My head shook dolefully from side to side.

"Bah! This state of affairs can't last, Cliff."

"I think it will. Winstead was right that time. The pendulum swings, and since 1945 it's been swinging against us. We're ahead of the times—or behind them."

"Don't speak of that fool, Winstead. You're making the same mistake he did. Trends are things of centuries and millenniums, not years or decades. For five hundred years we have been moving toward science. You can't reverse that in thirty years."

"Then what are we doing?" I asked sarcastically.

"We're going through a momentary reaction following a period of too-rapid advance in the Mad Decades. Just such a reaction took place in the Romantic Age—the first Victorian Period—following the too-rapid advance of the eighteenth-century Age of Reason."

"Do you really think so?" I was shaken by his evident self-assurance.

"Of course. This period has a perfect analogy in the spasmodic "revivals" that used to hit the small towns in America's Bible Belt a century or so ago. For a week, perhaps, everyone would get religion and virtue would reign triumphant. Then, one by one, they would backslide and the Devil would resume his sway.

"In fact, there are symptoms of backsliding even now. The L. R. has indulged in one squabble after another since Eldredge's death. There have

been half a dozen schisms already. The very extremities to which those in power are going are helping us, for the country is rapidly tiring of it."

And that ended the argument—I in total defeat, as usual.

A month later, the *New Prometheus* was complete. It was nowhere near as glittering and as beautiful as the original, and bore many a trace of makeshift workmanship, but we were proud of it—proud and triumphant.

"I'm going to try again, men"—Harman's voice was husky, and his little frame vibrant with happiness—"and I may not make it, but for that I don't care." His eyes shone in anticipation. "I'll be shooting through the void at last, and the dream of mankind will come true. Out around the Moon and back; the first to see the other side. It's worth the chance."

"You won't have fuel enough to land on the Moon, boss, which is a pity," I said.

"That doesn't matter. There'll be other flights after this, better prepared and better equipped."

At that a pessimistic whisper ran through the little group surrounding him, to which he paid no attention.

"Good-by," he said. "I'll be seeing you." And with a cheerful grin he climbed into the ship.

Fifteen minutes later, the five of us sat about the living-room table, frowning, lost in thought, eyes gazing out the building at the spot where a burned section of soil marked the spot where a few minutes earlier the*New Prometheus* had lain.

Simonoff voiced the thought that was in the mind of each one of us: Maybe it would be better for him *not* to come back. He won't be treated very well if he does, I think." And we all nodded in gloomy assent.

How foolish that prediction seems to me now from the hindsight of three decades.

THE REST of the story is really not mine, for I did not see Harman again until a month after his eventful trip ended in a safe landing.

It was almost thirty-six hours after the take-off that a screaming projectile shot its way over Washington and buried itself in the mud just across the Potomac.

Investigators were at the scene of the landing within fifteen minutes. and in another fifteen minutes the police were there, for it was found that the projectile was a *rocketship*. They stared in involuntary awe at the tired, disheveled man who staggered out in near-collapse.

There was utter silence while he shook his fist at the gawking spectators and shouted: "Go ahead, hang me, fools. But I've reached the Moon, and you can't hang *that*. Get the FSRIB. Maybe they'll declare the flight illegal and, therefore, nonexistent." He laughed weakly and suddenly collapsed.

Someone shouted: "Take him to a hospital. He's sick." In stiff unconsciousness Harman was bundled into a police car and carried away, while the police formed a guard about the rocketship.

Government officials arrived and investigated the ship, read the log, inspected the drawings and photograph he had taken of the Moon, and finally departed in silence. The crowd grew and the word spread that a man had reached the Moon.

Curiously enough, there was little resentment of the fact. Men were impressed and awed; the crowd whispered and cast inquisitive glances at the dim crescent of Luna, scarcely seen in the bright sunlight. Over all, an uneasy pall of silence, the silence of indecision, lay.

Then, at the hospital, Harman revealed his identity, and the fickle world went wild. Even Harman himself was stunned in surprise at the rapid change

in the world's temper. It seemed almost incredible, and yet it was true. Secret discontent, combined with a heroic tale of man against overwhelming odds—the sort of tale that had stirred man's soul since the beginning of time—served to sweep everyone into an ever-swelling current of anti-Victorianism. And Eldredge was dead—no other could replace him.

I saw Harman at the hospital shortly after that. He was propped up and still half buried with papers, telegrams and letters. He grinned at me and nodded. "Well, Cliff," he whispered, "the pendulum swung back again."

NUMBERS WITHOUT MEANING

Cambridge University Press publishes a small pamphlet containing several long pages of numbers, arranged somewhat after the fashion of logarithm tables, which are carefully selected to have no meaning whatever. The booklet consists of page after page of pure numbers, one after the other, in long columns, without other text. The numbers have no relation to each other, refer to nothing whatever, have no meaning, and represent no known function or other mathematical formula.

In fact, they are selected for that purpose—random numbers. In mathematical work of various kinds, particularly work applying to probability, random numbers are frequently wanted because they *are* random. It's fairly easy, of course, to "pick a number between one and infinity," but it gets to be definitely difficult to pick several thousand such numbers without repeating and without involving some order of arrangement. The Cambridge University Press booklet is designed to aid mathematicians in finding a series of random, and hence necessarily unrelated and meaningless, numbers.

The booklet has definite industrial uses. The Bell System Telephone Company finds use for it in calculating how many units of cross-bar dial switching apparatus will be needed to handle the demands of a given number of thousands of telephone stations. Obviously, one switching unit can serve more than one subscriber-station, since the subscriber does not call continuously, but the question is, how many more than one can it serve? Calls made are, in a large population, almost a pure probability function, and the probability mathematics can be used to determine it.

Equally, atomic physicists, chemists, astronomers, and those doing telepathy research are interested in probability functions. Numbers without meaning become valuable tools because they have no meaning!

ARTHUR MCCANN.

CITY OF THE COSMIC RAYS

By NAT SCHACHNER

CITY OF THE COSMIC RAYS

Past, Present and Future back again! In another of the strange, and strangely isolated cities that survived an age of warfare, three adventurers from three ages bring trouble.

By Nat Schachner

Illustrated by Wesso

THE rocketship of Harg zoomed swiftly along. The thunder of its jets made a trailing whisper of sound. Far below, the blue Pacific receded to the east and the flat jungle of what had once been India made a dank smudge on the horizon. The three men—dissimilar in race as well as in time—peered down at that smudge with faint hope too long deferred.

Sam Ward—man of the twentieth century—said thinly: "In my day India teemed with countless millions. Surely some of them were left after the great holocaust to rebuild anew some manner of civilization."

Kleon, the Greek, clashed his tarnished shield with battered sword. His blue eyes gleamed with fierce luster. "By Zeus!" he exclaimed, "it was even here that we charged Porus and his mighty elephants, and won such a victory as even the great Alexander had never won before. Aye, and it was even from here that my trireme separated from Nearchus' fleet and sped eastward over the flood to the far Cimmerian shore where I became Quetzal and slept for nigh ten thousand years."

"And a very good thing it was, friend Kleon," nodded Beltan, Olgarch of Hispan. "Had it not been for your radium-induced slumber, I had still been an Olgarch in the neutron-walled city of Hispan, circumscribed by use and wont and unknowing of the outer world; nor," and his proud, aristocratic gaze softened as it rested on his two comrades, "would I have had the knowledge of two such rare spirits as you."

"Never mind the compliments," growled Sam, embarrassed. "If we don't hurry up soon and find some manner of people on this forsaken earth capable of making a stand against the rocket hordes of Harg and their new associate, Ras, our numbers are up. That fuel you manufactured back on the Island of the Individualists, Beltan, is almost gone."

The Olgarch looked back over the Pacific thoughtfully. "If we land, Ras will catch up to us. Even now, no doubt, the tentacles of his thought are tracing our patch."

"And if we don't land?" demanded the Greek.

"We crack up just the same." Sam forced a grin. "We're damned if we do; and we're damned if we don't."

Once more they stared down over the side of their ship. India rolled rapidly beneath them. Nothing broke the dark texture of the billowing vegetation; nothing that could even remotely be construed into any evidence of human life. Like all of North America, like most of South America except where the neutron-walled city of Hispan stood solitary and the underground kingdom of Harg had erupted its stellene-sheathed

hordes, Asia seemed a desolate waste. Life had vanished in a plague of former wars, and none had remained to rebuild laboriously the upward strivings of the race.

Sam shivered suddenly. "Curious," he said with a swift, upward glance. "But I have a sensation as though a cloud just passed over the sun, cutting off its warmth."

Kleon shaded his eyes, blinked at the molten ball of fire that blazed overhead. "You are imagining, my friend," he stated. "There is not a single cloud in all the sky."

Beltan's tawny, proudly poised head flung back. A frowning look crept into his eyes. "Sam Ward is right," he announced. "Something is between us and the Sun, even though it is not visible. See; the Sun is now a yellowish-green—it is a color I have never seen before."

"It's getting deeper," puzzled Sam. "What does it mean?"

The Olgarch's frown deepened. "It means that both the ultraviolet and the infrared waves have been cut off, leaving only a restricted portion of the middle register. There is something—"

Kleon's blue eyes were keen as any hawk's. "There is a shimmer up above," he cried suddenly. "A dazzlement, as though the burnished shields of a Macedonian phalanx were pouring their blinding splendor into the enemy's eyes."

"Friend Kleon thinks always in terms of ten thousand years ago," Beltan said good-naturedly. "He—"

"He's right," Sam called out in a cracked voice. His long, lean arm pointed excitedly upward. "Only it looks like a bunch of mirrors—"

THE PROW of the rocketship tilted suddenly. The three strangely assorted men sprawled in a heap in the bottom of the hull. The steady roar of the tubes stuttered, stopped; then took up again their regular throb.

Sam fought his way to the controls, twisted desperately. His feet slid along the steep incline. Beltan untangled himself from the armored Greek and crawled toward the fuel tanks. "There's still enough fuel," he called. "What has happened?"

Kleon heaved precariously erect. "We're falling!" he shouted.

The muscles corded on Sam's arms as he twisted anew. "We're not," he cried. "We're rising. We're being pulled out into space."

The others clung unbelievingly to the side. There was no mistake about it now. The rocketship was climbing at an almost perpendicular angle. Beneath, the blue sea curved into a convex arc. The flat jungles merged into an indistinguishable haze. The keen air grew swiftly cold. Breathing became difficult.

"I can't control the ship," Sam gasped. "I've shoved the forward rockets on; but we're going up faster."

Kleon's shout was a thin squeak. "Air! Air! I can't breathe."

Beltan groped with cold-stiffened fingers for a gadget. He pressed, and tumbled headlong to the bottom. But even as he fell, the glassene covering rolled swiftly overhead, and the oxygen tanks began their labored pumping.

Sam's fast-purpling features subsided; his shallow gulping steadied to a normal pace. "You saved our lives, Beltan," he said, clinging to the steep-angled deck. "But for what? We're already ten miles up, and our speed seems to be accelerating. At this rate—"

Kleon's grip tightened on his sword. He brandished it threateningly toward the unclouded vault of heaven. "We'll fall straight up into the maw of the Sun God," he cried defiantly. "Know, Phoebus, that I, Kleon, a free Greek who walked with Aristotle and fought with Alexander, fear you not."

"I'm afraid," said Beltan with a little smile, "your Phoebus is too far away to hear your threats, my Kleon.

There is some suction or whirlpool in space, perhaps, that sets at naught our earthly forces."

"The shimmer is getting more dazzling," Sam cried out. "The Sun is still there, but it's elongating; as though we're watching it through distorted lenses."

Helplessly they saw the great ball of Earth turn majestically beneath. All Asia was a convexity disclosed to their view. Far to the east, the island of Asto, from which they had escaped, showed as a burned-over cinder. A scatter of tiny specks, surrounding a black beetle, moved slowly over the cobalt sea.

"The rocket horde of Harg," groaned Kleon. "They're hunting for us."

"They'll never find us here," Sam laughed harshly. "Nor will anyone else." His jaws tightened as he stared at the altimeter. "Twenty-five miles up and still going strong. Perhaps we're heading for the Moon. Perhaps there is a race—"

There was no sign of fear on the Olgarch's calm, proud face. He seemed to be working out a mere intellectual problem. "Our angle is rather to the Sun," he decided. "Perhaps our Greek who walked with Aristotle is wiser than—"

The sky above blazed with sudden hues. Fierce, blinding light stabbed at their eyeballs. The floor of the ship pressed upward with crushing force against their legs. The craft quivered in every metal strut and leaped upward with insupportable acceleration. The Sun divided into a thousand separate balls of fire, each glaring down at the hapless travelers with malignant eye. Terrific heat slashed through the insulated glassene top. A fiery furnace vaulted all the heavens.

"Look out!" screamed Kleon. "We're going to crash. There's an island—"

The inferno of light and heat engulfed them. Sam moaned and flung slithering down the ways, unconscious. On top of him piled Kleon and Beltan. The craft shuddered, decelerated as swiftly as it had previously soared. There was a bump that tumbled the three unconscious men into an inextricable heap. Then there was silence.

SAM had been only momentarily stunned. The multi-gravity acceleration and the plethora of blazing light had distended his veins almost to the bursting point. But now, as blood crawled back to normal flow, and he sat up, blinking, a new inferno struck upon his ears. This time it was a curious babble of sound; of many voices raisel in slurred elliptic speech that held a faint, yet recognizable resemblance to the once universal English.

Some of the voices were shrill, some were rumbling with deep bass tones; some cascaded in great cataracts of words, some were slow and meditative. Some seemed harsh with overmastering anger, some were vibrant with warm sympathy. No two were alike—in pitch, or timbre, or intonation. A babel of noise, a hundred separate voices heedless of each other, totaling up to a fearsome concatenation of sound that almost burst Sam's eardrums.

Involuntarily his hands went to his ears in a vain attempt to shut out the senseless confusion. Had he by some strange mischance dreamed what had been, and actually fallen into the nether jungle of India, where a chattering band of monkeys had taken him in tow?

But monkeys didn't talk a modified English. And monkeys did not resemble the conglomerate of strange and different, yet undeniably human beings, on whom his astonished eyes had opened.

They surrounded him in a chattering, diverse horde. There were hundreds of them. Men and women by all the evidences; yet like nothing he had ever seen before. Back in Hispan humanity had been normal; albeit divided into

Olgarchs, Technicians and Workers. Back in Hark, both fanatical leaders and militarized population had not offended his twentieth-century ideas. Even on the Island of Asto, where the Individualists had become huge, Overweighted brains bulging over spindly shanks and useless feet, he had not been too much surprised. In his own time, evolution had pointed the way toward such a possible goal.

But these people!

No two were alike. One was tall and willowy, with a tiny head that swayed like a fragile flower in a breeze. Another was short and squat—a powerful torso supported by stubby legs that moved with uncanny rapidity. One was an apple-green in color; another a deep vermilion. A huge yellowish beard swept the ground on one; next him was a woman with hairless, egg-shaped dome. There were those with a fine, down covering that made a feathery fluff of their bodies; and there were those whose skins seemed hard and chitinous. One man in particular had great, compound eyes that twirled their many facets round and round with swift dexterity. A half-grown girl—if girl she could be called—had shovellike hands, without thumbs or fingers, and hollowed like scoops that could hold a good quart of water without spilling.

Only in one particular were they alike—an ineradicable curiosity that made them swarm gesticulating around the bewildered twentieth-century *homo* who had the strangely catapulted into their midst.

He staggered to his feet, filled with sudden fear. "Beltan! Kleon! Where are you?" he shouted to make himself heard above the uproar.

"Here!" returned a familiar voice. Then, through the screaming press, burst two figures. Beltan, the Olgarch, calm and unperturbed, though there was a raw bruise on his forehead; and Kleon, his short, thonged javelin raised threateningly against those who might have hindered him.

"Praise to Zeus!" greeted the Greek. "We had thought you dead, friend Sam. But what are these chattering apes into whose midst we have been flung?" He raised his javelin again. "Back!" he cried harshly to the small-headed man with the willowy arms. "Back, or I'll—"

Long, prehensile fingers darted out in a blur of movement. The fantastic being deftly wrenched the weapon from his hands, poised it delicately in the tips of his own. Kleon's face darkened with rage. Never before had any foe done that much to him. He lifted his shield, tugged viciously at his sword. Sam swore and reached for his seven-chambered gun. Only Beltan remained poised and proudly motionless. "It is better that we make no hostile gestures," he warned.

His words were not necessary. Kleon's hand seemed frozen to his sword. The nicked and rusted weapon was suddenly of a weight that bowed his powerful frame into a straining arc. The gun that Sam had drawn twisted like a live thing out of his hand and fell thudding to the glassy floor. His fingers tingled from the electric shock that had darted unseen against him.

BELTAN'S smile was steady. He faced the still-chattering crowd with calm gesture. "We have come in peace," he said. "We are strangers and do not know your customs. What manner of world is this?"

A fat individual waddled through the press toward them. He appeared the most nearly human of the lot, though his bulk and peculiar, ducklike gait would have been ludicrous under any other circumstances. His skin was of a chocolate hue, and two deep-blue eyes stared out at them with startling incongruity. A chin of ample dimensions waggled at them.

He stared at the three intruders with those blue, guileless-seeming eyes. Then

he began to laugh. The laughter started in his chocolate paunch that shook like a jelly. The ripples traveled upward and almost submerged his eyes in deep rolls of fat. His mouth opened and gales of high-pitched, squeaking sounds poured forth. The tears rolled down his quivering cheeks. The others of that strange crew took up the laughter. Bedlam had broken loose.

Sam rubbed his still-tingling hand. Kleon's straining form wrenched mightily at the invisible force that weighed him down. Beltan's face went white. Never, since Hispan had immured itself behind impenetrable walls, had any living creature dared laugh at an Olgarch. His slim, aristocratic fingers crept toward the electro-blaster that dangled from his belt; paused. "What," he asked with careful restraint, "is so funny about us?"

The fat little man doubled up again with choked laughter; then he straightened and wiped the tears out of his eyes. "Sorry," he gasped, and his squeaky voice trailed off into titters, "but I couldn't help it. You . . . you really look so . . . so *monotonous!*"

"Monotonous?" echoed Sam angrily. His hand had regained its circulation. Imperceptibly his foot inched his fallen gun toward him. "What do you mean?"

The Buddhalike figure waved his pudgy arm weakly. "First let me release your triplet who was foolish enough to threaten us with his toy weapons."

The air seemed to shimmer toward Kleon. He straightened up suddenly, like a bent sapling from which the pressure had been released. Amazement gutted his clean-chiseled features—amazement, and considerable awe. Without a word, the small-headed, swaying creature returned to him his javelin.

The chocolate man said: "You drawl words horribly, yet your speech appears like an earlier form of ours. Yet you do not understand a simple word. I meant that you are as alike as one electron is to another. Were it not for your curious garments the three of you would appear merely as a bad dream, thrice repeated. And your proportions!" The chuckle started irresistibly. "Pardon the rudeness; but if any artist among us should have painted creatures with heads and limbs and general color schemes such as yours, we should have thought him mad and thrust him headlong out of Dadelon."

A surge of bewildered wrath flooded Sam. What! These nightmare travesties, these zoological freaks, dared poke fun at such masterpieces of mankind as Kleon and Beltan—each the highest type of a particularized civilization? Modestly, he did not consider himself in his comrades' class; though his tall, lean form and firm-modeled face had evoked many a fluttering sentiment in the girls of a remote twentieth century. And as for likenesses—

Kleon forgot his amazement. His Greek ideal of symmetry was outraged. "Have you no eyes?" he demanded passionately. "See you not the profound differences between us?"

"No," the chocolate man said frankly.

Sam gulped; then started to grin. "Everything is relative," he said. "I remember that I had the same trouble back in our own time, differentiating one Japanese or Chinaman from another. We evidently furnished the same difficulty to this—uh—gentleman."

"Dag!" the chocolate-colored man obliged. He waved toward the willowy man. "He is Pol."

Beltan had regained his imperturbable poise. "I can see your point," he acknowledged. "You are so violently different from each other that we must naturally tend in your eyes toward a certain sameness, though we represent three distinct races both in space and time."

Dag looked astonished. "*Violently* different?" he echoed. "It is simply that

we are individuals. Why shouldn't we look different? We are separate entities."

Sam gave it up. After all, there was something in what this funny-looking duck was saying. There *was* a certain sameness among the peoples of his time that did not correspond to their differing mentalities, viewpoints and sensations.

"O. K., Dag," he said agreeably. "But what is this place you call Dadelon, and why did you drag us up here as prisoners?"

For the first time he was able to view his quarters as a whole. The gesticulating horde had fallen back a bit, allowing them breathing space and room. Only Dag and the small-headed man called Pol were close to them.

THEY were in a huge central chamber whose walls were all of a transparent quartz. Through the gleaming walls they could see other chambers, mostly smaller, stretching for several miles in radius. Overhead were other tiers, likewise of the same transparent quartz. Outside was a deep, purplish space in which the sun, a reddish-yellow orb, poured its blinding brilliance. Its darting rays were only slightly impeded by the barriers of the floating city. Stars burned steadily in the purple depths, and a gibbous moon sailed serenely to the left.

Involuntarily Sam looked down. His knees wabbled, and he caught at Beltan to keep from falling. For the moment he had thought he was standing on nothingness. Incredible depths yawned below. Thirty miles of impalpable atmosphere in which tiny white clouds formed, dissolved and reformed. Earth was a vast orb, painted in brilliant hues, and seen through a blue-green ocean as once he had seen the famous subterranean gardens through a glass-bottomed boat off Bermuda.

That was it! He *was* viewing the Earth through a boat with a glass bottom—a great quartz city that floated by some scientific means unknown to him as yet in the rarefied reaches of the outer stratosphere.

Dag was pained. "You are not prisoners," he said. "It is true that Pol brought your curious craft into Dadelon by means of our magnetic vortex. But that was scientific curiosity only. Pol, you see, is a specialist in life forms. Poor fellow; there isn't much of strange and startling variants in Dadelon or in our sector of space. A few spores, some drifting bacteria, and that is all. Twice, in fact, he was lowered into the atmospheric ocean below and actually brought back with him most curious animals from the bottom. But such expeditions are hazardous—it was difficult to breathe, and he was almost smothered by the dampness and the pressure."

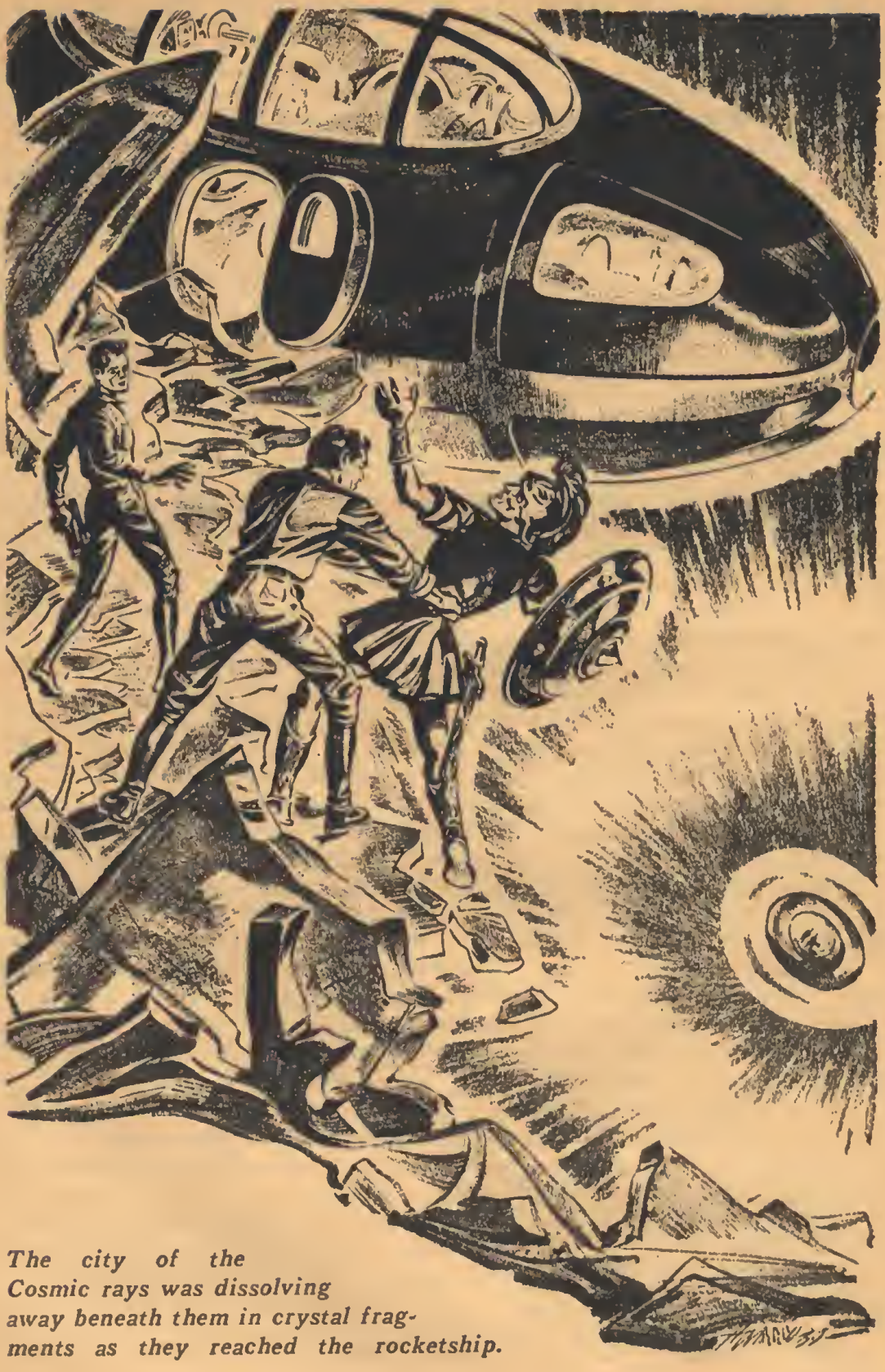
Sam thought there were enough curious life forms at hand without bothering about going elsewhere, but he was wise enough to keep it to himself. Pol was nodding his tiny head—not larger than a grapefruit—with a self-satisfied smile.

"As for Dadelon," continued Dag, "this is our city, our home. For the past thousands of years, since our remote ancestors fled to the skies to avoid the last plagues that wiped out all mankind, we have drifted steadily around the inimical orb below. Never until now have we seen vestiges of any supposedly intelligent life beneath. We thought we were all that were left."

"Your path evidently never intersected my city of Hispan," the Olgarch assured him. "Until recently, of course, the city of Harg was underground, and the Island of Asto was protected by an interlacing of thought screens."

Pol looked astonished. His elongated body curled itself almost into a question mark. "Do you imply that there are others besides yourselves down there on Earth?"

Kleon shook his javelin down toward



The city of the Cosmic rays was dissolving away beneath them in crystal fragments as they reached the rocketship.

the cobalt ocean. "Thousands!" he declared. "Hundreds of thousands! The rocket horde of Harg, fanatical, like a swarm of devouring locusts, led by their leader, Vardu, and that traitorous renegade from Asto, Ras. Twice we escaped from them, but they pursue. We had thought to find some race that could help us make a stand against them." His arrogant eyes surveyed the motley crowd with a certain contempt. "But I fear me there is little hope."

Beltan frowned disapproval at the hot-headed Greek. "I do not know, Kleon," he remarked. "Do you forget your former attitude of reverence when you thought to wield your sword?"

The little fat man waved that aside. "We have weapons of our own," he averred. "But tell me more of yourselves and these—ah—people of Harg."

It was in the privacy of his own quartz-inclosed chamber that they finished the story. Each of the thousand-odd Dadelonians had his or her own cubicle, into which no one else might intrude except by invitation. It could hardly be called privacy, however, in the twentieth-century idea of that word. Rather it was the privacy of the goldfish, immured behind transparent walls. But Sam noted that, once the first shock of their sudden appearance had passed over, the others paid no further attention to them, or to Dag or Pol.

The chocolate man wagged his huge head solemnly when they had finished their tale, and Pol's elongation swayed with sinuous movements.

'Your story is a strange one," said Dag. "For six thousand years we thought ourselves the sole survivors of an ancient humanity on this Earth; now we find there are others—curious creatures who cannot be told apart, spawning with regularity and a deadly sameness."

"What a pity!" sighed Pol. "The study of one is the study of all. A scientist would be bored among you."

Sam wanted to retort that a scientist would go crazy among the Dadelonians, but he had sense enough to suppress the retort. Instead he asked: "But how do you account for this—er—remarkable variance among you? You have inbred for over six millennia—you should by now have been far more homogeneous than your ancestors."

POL smiled proudly. "That is because we have not been bound to the surface of the Earth, submerged under a veritable atmospheric ocean. Did you ever hear of cosmic rays?"

"Naturally!" answered Sam. Beltan nodded thoughtfully; but Kleon looked merely blank.

"Well, up here we get their full effect. There's practically no atmosphere above us to slow them down or scatter their drive. The quartz walls let them through as though they were sieves. Their intensity is over a hundred times greater than down on the surface."

"I get it now," Sam cried excitedly. "Back in our own time there had been experiments with the effect of rays on fruit flies. It was found that even X rays, much softer in effect than cosmic rays, created sports and mutants in tremendously greater numbers among the offspring."

Beltan nodded. "We didn't work with cosmic rays in Hispan, because the neutron walls were impenetrable to them. But we had other types, by means of which we changed small-animal heredity at will."

Dag's blue eyes were submerged in a chuckle. "We changed ourselves—or, rather, it was done for us without our will. The cosmic rays bombard our germ cells, and knock the genes of inheritance into strange new combinations. There is only one chance in a million that any two of us would be alike."

"That has never happened yet," Pol put in complacently. "It would be an insupportable disgrace for two of us to resemble each other."

Other times, other customs!—thought Sam. Back in the twentieth century the shoe was on the other foot. One who did not resemble his fellows would be termed a freak, a monstrosity.

"How," asked Beltan suddenly, "do you keep your city of Dadelon afloat?"

"I do not know," was the startling reply.

The three comrades stared. "In the name of Zeus, who does then?" Kleon exploded.

Dag shook his head vaguely. "Do you know, Pol?"—he turned to the willowy man.

Pol wrinkled his tiny forehead into puzzled lines. "I am not sure," he answered slowly, "but it may be Tek."

"And who in blazes is Tek?" Sam demanded.

"He is the one whose eyes are compound lenses," said Dag. "You see, no two of us are alike in our intellects or pursuits any more than we are alike in outward form. We do the things we personally desire to do, without regard to what any one else is doing. I, for example, am interested only in laughter and the incongruous." He started to chuckle again, and his fat paunch heaved. "That is why I took charge of you three."

Kleon's eyes flashed; his hand half raised the javelin. Beltan's arm bore down heavily on him. "Stop it, you fool!" he whispered fiercely. "You've had one lesson. That should have been enough."

Dag did not appear to see this byplay. "As for Pol, he is a biologist. I believe we have an astronomer now," he turned to Pol for confirmation.

The willowy man said: "Yes, that would be Arne. Some days ago I saw him fixing up a telescope."

"That's the way it goes," beamed Dag. "Each man and woman does what pleases them best. It is very rarely that the same pursuit pleases two at a time."

Sam felt his head bursting. Was *he* crazy, or were these amazing monstrosities lunatics as well. "Do you mean, then," he gasped, "that it is quite possible that at any given time there may be whole fields of knowledge without anyone who knows *anything* about them?"

They both nodded. "Surely. Why not?"

"But . . . but," Kleon gasped, "suppose this flying city of yours should decide to stop flying?"

The two Dadelonians looked at each other blankly. *That* thought had never entered their heads. "But it *won't*," Dag retorted.

"You're quite right," Beltan said politely. "I believe I know why Dadelon has remained aloft these thousands of years. Its quartz walls are not true quartz. It is a synthetic product, fused under tremendous longitudinal stress. As a result the molecules have polarized themselves and form tiny magnets, of opposite sign to the magnetic flow of the earth beneath. At this particular height the two forces just balance each other, and the city drifts along. Inasmuch as the earth's magnetism is remarkably constant, no shift in the height has so far been necessary. What will happen in the future, of course, cannot be prophesied."

Pol permitted a glint of admiration to creep into his small, yellowish eyes. "Dag," he told his companion, "this stranger from beneath knows more than we gave him credit for. I remember now that Tek *did* say something of the sort."

SAM rose suddenly to his feet. He was becoming tired of all this palaver. They were wasting time. Below, Vardu and the mightier Ras were leading a countless horde of warriors to conquer all the Earth. Sooner or later they would discover the overhead city of Dadelon. There were weapons here—he remembered their recent experience

rufully—that, properly employed, might stop their irresistible march. But they must work fast.

"Look, Dag!" he blurted out. "And you, too, Pol. We've got to do something fast. The rocket hordes may be upon you any minute. Why don't you organize your people at once to resist?"

Dag smiled indulgently. "You ask an unthinkable thing. Dadelon *never* works as a unit. That is the method of slaves, or men without individualities—like your soldiers of Harg, for example. We each employ whatever method seems best for ourselves. I utilize a little mechanism that increases the gravitic pull of every molecule upon which it is directed." His blue eyes twinkled on Kleon. "The stranger Greek has witnessed its results. Pol relies upon the incredible swiftness of his hands. Tek has managed to concentrate through his many-lensed eyes the power of his will. An electric impulse of any desired strength flashes out upon his foe and numbs him to helplessness. Others have other methods of attack or defense. I do not know them all—it is not the proper thing to inquire."

"You are as bad as the Individualists on Asto," Kleon declared angrily. "They too had power enough to wipe out all Harg, but they would not employ their weapons in concert. Instead, *they* were wiped out. Only Ras, the renegade, had sense enough to act with others; and he was a traitor to his own."

Dag shrugged indifferent shoulders. "They do not bother us now. Until they do—"

Sam sat down abruptly. A sudden dizziness had assailed him. Tiny tentacles were groping in his skull, plucking at his brain, sucking it dry.

The Olgarch moved swiftly to his side, caught him by the arm. "What is the matter, Sam Ward?" he said, concerned.

Sam shook his head violently from side to side, trying to clear it of that strange, crawling feeling. "I . . . I do not not know," he gulped. "I can hardly think. My thoughts flow out; fingers are pulling—"

"By Poseidon!" exclaimed Kleon, paling. "I had felt the same way over the Island of Asto. Ras has come! Ras has found us out!"

Sam's head slumped. His eyes glazed; his breathing became heavy. They could hardly hear his thick, low stammer. "Yes . . . it's . . . Ras. He . . . is—"

Pol's tiny yellow eyes were bright with scientific interest. His elongated body swayed toward the stricken man. "Curious manifestation," he observed. "Action at an immense distance. Even Tek can control by the force of his will only within the radius of his sight. Perhaps this primitive person is particularly susceptible."

Dag said with distaste, "Take him away. I hate to look at sick people. They are not amusing."

Beltan said nothing. His fine, aristocratic features were tense. His long, lean knuckles pressed down hard upon Sam's skull, twisted with peculiar motion over the temples. Back and forth, back and forth, interminably, while the Greek watched helpless, aghast. A magnificent fighting machine—the finest the world had ever seen—this form of warfare, this attack by an invisible foe, bewildered him. He could only clutch at his weapons and mutter fiercely.

For long minutes the Olgarch worked with desperation over the semiconscious man. Dag was obviously bored. He crossed his fat little legs and sat with pudgy hands folded over a gently breathing chocolate paunch. Pol, however, watched the three strangers with greedy eyes, sucking in their diverse sensations, tabulating them in his mind for future analysis.

At last Beltan's ministrations showed results. Or else Ras, having pumped his victim dry of the knowledge he wanted, withdrew his thought-impacts.

Sam groaned; sat up with a jerk. "Where . . . where—" he started; then remembered. Fine droplets of perspiration beaded on his reddened temples. He looked up at his two friends. "Ras knows where we are," he said dully. "In a short while he'll lead Vardu and the rocket horde of Harg against this city in the sky. There is nothing we can do."

LAUGHTER interrupted him. They swung around, blinking in amazement. It was Dag. He leaned back in his seat, and his whole body shook with mirth.

"What's so funny?" Sam snarled.

Dag wiped the tears from his eyes. "You three!" he gasped. "Our books speak vaguely of a curious trait called *fear*, that once was prevalent before Dadelon was built. But no one of us ever saw it truly in action. I find the sight of it in you the most mirth-tickling thing I have ever experienced." And again he rolled in his seat with huge laughter.

Kleon shook with fury. "By Ares, God of War!" he ground out. "I am a coward, am I?"

Beltan's voice held a rasp Sam had never heard in it before. "Ten thousand years ago men knew more of fundamentals than you do here in Dadelon. Truly I am ashamed of this new century of ours. Ashamed that a Greek of the time of Alexander and an American of the twentieth century—by all the laws of evolution, primitives—should see the depths into which we have fallen."

His words were cold, cutting, remorseless. "Surely we know more of science, of weapons of destruction. We know how to tame the atom, how to transport ourselves perhaps to the stars; we have solved the problem of space and of time; and have learned to project our thoughts with overpowering force. But to what end?"

His proud face was pale with an inner contempt. "To kill each other off the better; to conquer for the mere lust of conquest; to ground our fellow men into the dust as slaves; to sit there, as you do, Dag, and seek food for silly mirth in the sufferings and despairs of strong men."

He whirled on Sam and Kleon. "I apologize to you," he said simply, "for the loathsome degradation of this ninety-seventh century. All the beauty, all the hope, all the aspirations of mankind have sunk into the mire. You, Kleon, had your Aristotle and Plato and Sophocles; you, Sam Ward, had your Einstein and Darwin and Shelley; but we—what have we to show? Gano of Hispan, Ras of Asto, Vardu of Harg, and now"—he indicated Dag—"this maudlin seeker of laughter."

"You forget, friend Beltan," interrupted Kleon, "there is yourself; one shining spot at least in this barbarous world of the future."

"Each age has its good and its bad." Sam observed wryly. "All ages tend to glorify the past, and call it golden. But in my time there were dictators and fanatical conquerors; there was war and starvation and cruelty; and friend Kleon could tell you some shocking stories, if he wished, of slaves and babes exposed on the hillsides to die, and the poison hemlock of Socrates. We have found the bad so far in your time, Beltan; but somewhere, I feel it in my bones, there exists a race, truly civilized, truly evolved."

The Olgarch smiled thinly. "Still dreaming that bright, implausible dream, Sam Ward. But now, I am afraid, even if such a race *does* inhabit some remote sector of this Earth, it is too late."

He pointed downward through the magneto-quartz base of the floating city. "See! There come the rocket hordes of Harg with the huge ship of Vardu and Ras in the lead."

The transparent quartz acted as a magnifying lens. Far to the east, more than two hundred miles away, and

thirty-odd miles below, the glassy Pacific seemed dotted with an immense swarm of tiny black specks, clustered in solid array behind a larger oval shape.

Even as they gaped, the lead ship swerved abruptly in its course, pointing its nose directly toward the shimmering city that hung in the heavens. Obediently, like a flock of marionettes pulled on a single string, the myriad specks swung to follow. Faint streaks of red painted the blue of the sea underneath. A hundred thousand stellene-clad warriors, each in his individual sheath, each armed with a stellene weapon, hurtling in the wake of his leaders, fired with the lust to kill and burn and slay!

Sam whirled back on the chocolate-colored Dadelonian. "Well?" he snapped. "Now you can believe us. There they come, armed to the teeth with weapons as good or better than your own. And they are a unit—a hundred thousand powered by a single will; against your paltry hundreds who pride themselves on being different—each for himself and devil take the hindmost. They will crush your city and blast you out as sure as fate, unless you act at once."

Slowly Dag's chuckles subsided. Curiously enough, the flailing excoriations of the three men Pol had captured did not offend him. Nor had Pol paid any heed. They were armored in the tight impenetrability of themselves, impervious to all external shafts. Never, in the long history of Dadelon, had any man or woman presumed to tell another what to do. It was live and let live, with a vengeance.

The little fat man with the incongruous blue eyes arose. "I have not laughed like that in ages," he said weakly. "You three are the essence of comedy. It was not enough that your outward forms are absurd; but your minds jiggle from silly thought to sillier thought like aimless molecules in free gas. If those beneath who you seem to fear so greatly resemble you, we shall be rid of them in the twitch of an eyelash. Now go, please; I have certain preparations to make."

He waved his hand in careless gesture and Pol, like a wavering blade of grass, slid through the door that led out of the cubicle. Kleon scowled and followed, clutching his shield and fingering his javelin. Sam stared in amazement at the little man as he slumped back into his chair, closed his eyes, folded his hands and began to snore.

"What the—" he ejaculated; but the Olgarch's quick nod let him outside.

"Let's follow Pol," he whispered. "Perhaps we can do better with him alone."

THEY caught up with the elongated question mark without difficulty. His transparent cubicle was some three doors removed. He did not look up at their entrance. He was contemplating his long, flexible arms with a certain rapt interest.

"Pol!" Sam called his name very loud.

The small-headed man looked up then; but his gaze immediately returned to his hands.

"Now look," Sam said desperately. "You're a scientist. You ought to understand that destruction will be upon you in no time if you don't get busy. What good are your flexible hands against death at a distance?"

Pol said: "I know. That's what I'm sitting here thinking."

"Thinking?" echoed Kleon scornfully. "This is no time for thought; this is the time for action."

"Unless," added Beltan, "one can think with the same deadly effect as Ras."

"Get busy, then," Sam urged. "Get all your Dadelonians together, and plan a common defense. Among them there may be sufficient weapons."

Pol shook his head. "It is imposi-

ble," he stated. "We don't even think alike. How could we work together? We speak a common language, but that is all." He rose and stood swaying in a mournful sort of way. "No; each one of us must defend himself according to his own methods and capabilities. There is no other way."

"The price of civilization," Beltan murmured. "It evolves genius, and in the doing, the co-operative instinct is wholly lost. Back on Asto genius proved selfish, indifferent to all fate, even its own. Here genius has diverged so widely it has no common basis with one another, even if it wished."

Kleon said violently, "Let us leave these fools to their fate then. Let us get our rocket plane and escape."

"It is too late!" Sam pointed downward.

It was a magnificent sight. A hundred thousand stellene-sheaths, transparent as the quartz of Dadelon itself, each with a dark-visaged, fanatical Hargian within, clutching his stellene tube from which disintegrating death could blast at the touch of a knob, hurtling upward through the purple void at hundreds of miles an hour, converging in a huge swarm upon the embattled city in the sky. Red flame streaked backward from their rocket tubes, but no sound penetrated to the watchers. The air was too thin to carry even the lightest whisper.

On they came, growing swiftly on the vision. The great ship of Harg, inclosed against the vacuum of space, and holding in its hull the oddly assorted pair—Vardu and Ras—stood momentarily aloof.

"Come on," Sam shouted to his friends. "There's no use standing here and dying tamely."

He darted out of the cubicle and flung down the corridor, Kleon at his heels. Sam's automatic was in his hand; Kleon held his shield aloft and gripped his javelin at the hilt. The flame of battle illuminated his classic features, clean-cut as any medallion. Beltan unhooked his electro-blaster and followed at a slower pace. A thin smile flicked over his noble countenance. What good were their weapons here? Sword and javelin; bullet-emitting gun—outmoded weapons, incapable of piercing stellene tubes, even if within range. His electro-blaster, firing blue electric bolts, was far more deadly. But it was one against a hundred thousand.

As they pelted along the transparent pasageway, they saw in each cubicle, calmly seated and seemingly unaware of approaching disaster, the strange and various population of Dadelon.

"The enemy is here," cried Sam. "For God's sake, wake up, you fools!"

But no one stirred; no one lifted his head as though he had heard. The quartz doors in fact had closed and hermetically sealed them in, each apart and separate from his fellows.

THE THREE comrades came to the end of the road; to the crystal-clear, outer wall of the city. Kleon looked amazed, as though it had just dawned on him. "How can we get at them?" he asked, bewildered. "If we pierce the wall, we die. We fall out or suffocate from lack of air. We're in a trap."

Beltan nodded. "A trap," he said without a muscle quivering, "from which there is no escape."

A mighty simultaneous jet of furious flame burst from a hundred thousand tubes. It impacted on the magneto-quartz of Dadelon with a crash as of a hundred thousand thunderbolts. The three men hurled up their arms to shield their eyes from the blinding blaze; their involuntary cries unheard in the chaos of sound. They flung back, tumbling and staggering, from the terrific concussion.

Beltan was the first to recover his vision. "Look!" he cried. "The magneto-quartz is more resistant than I

thought. It's only smashed in spots."

But those areas of destruction were serious enough. A half dozen cubicles sagged outward to the cold and semi-airlessness of space. The crystal walls were fused and spattered with the dust of destruction; their occupants dropped lifeless and bloated, accelerating as they fell, toward the distant earth.

"It's a miracle," groaned Sam, "but Dadelon can't stand another blast. The whole surface is pitted and scored. Here they come again."

Again they threw up their arms to shield their eyes from the coruscating outburst of power. In each of the remaining cubicles the survivors sat, motionless, seemingly unmindful of the fate of their fellows.

Again came the roar and thunder of sound. Again they were blasted back along the corridor by the bludgeoning blows of disintegration. Confused, stunned, unknowing how this time they were still alive, they staggered to their feet. Another five of the sealed cubicles had smashed, and spilled their human contents into the void.

But something else had happened as well. This time the attacking hordes had not escaped scatheless. Hundreds of the stellene sheaths drifted helplessly in space, colliding, smashing into each other, hurtling downward in a cataclysm of destruction.

In amazement they looked back into the city of Dadelon. They saw Dag, placid as ever, ensconced in his chair, fingering a tiny metal disk from which shimmering lines of force traveled out in long, arcing curves that converged again outside the walls. Wherever they met in single focus, in contact with a stellene tube, that tube and its occupant seemed weighted with an unbearable weight. In spite of belching rocket gas, in spite of all the frantic efforts of the Hargian within, the tube plummeted down through the miles of space like a stone cast into a well.

"The gravity-intensifier," said Beltan with detached interest.

"Look at that fellow with the eye of a bee!" exclaimed Kleon.

They saw Tek—standing in his crystalline chamber—his great, faceted eyes agleam like photoelectric cells. The veins on his yellowish forehead bulged with fierce concentration. Sparkles of light darted from the turning orbs. Wherever they impinged, a Hargian warrior stiffened in his sheath, numb and rigid. The stellene envelope, still firing in continuous flame, leaped onward undirected, unmanageable. Tens of runaway tubes, smashing into each other, exploding in a terrific cascade of blazing fuel, shards of metal and fragments of flesh.

The girl with the shovel hands was cupping a parabolic mirror in her capacious appendage. Light flashed outward. A hurtling soldier, compact with oncoming death, suddenly became vague and tenuous. The molecules of which he was composed seemed to be pried apart by the force of the beam. First he was a fast-moving gas, with shape still retained; then he spread into a gigantic cloud that dissipated insensibly into the limitless void.

A man—all legs and bulbous head, with but a slender torso in between—aimed and clicked a funnellike affair at the invaders. At each click a plunging Hargian exploded.

BUT meanwhile terrible toll was being taken of the beleaguered city in the air. More and more of the cubicles were vomiting forth their distorted, disintegrated contents; more and more the entire surface of the inclosing shell was crumbling into powder under the flaming conflagration.

Thousands of Hargians had died, but there were thousands on thousands more. Hundreds of Dadelonians had died; but there were only a few hundred left to ward off complete annihila-

tion. Half of the floating magneto-orb streamed downward in ruining fall; in the other half the survivors sat calmly, using their diverse weapons with placid deadliness.

"It's magnificent; but it isn't war!" cried Sam. "If only the fools had gotten together in the beginning. Any one of those weapons, multiplied in numbers, in the hands of an organized and determined people, might have staved off the rocket horde of Harg. But as it is—"

It was a miracle that the corridor was still intact. A piercing dart at any point would send the prisoned atmosphere shooting out into the semivacuum and bring swift suffocation to the three men who crouched there, helpless, unable to join the fight, unable to do anything but watch.

"It won't be long now," Sam declared bitterly.

Kleon shook his javelin in helpless fury. If only he could have met them on solid ground, his strong young legs

Even as he spoke, a blast shook all the neighboring cubicles. Pol, still surveying his useless hands, making no effort to find another method of defense, catapulted suddenly outward from a wide-ripped chamber. Down he fell, through the surging mass of stellene tubes, his elongated, wavering figure ludicrously twisted into a great question mark, plummeting toward the tangled jungles of India far beneath.

well-balanced, his good sword thrusting. But here—

Beltan's steady gray eyes probed the screaming death that ringed them in. They clung thoughtfully to the rocket-ship of Harg that as yet drifted aloof on the edge of the fray.

"I wonder," he murmured, "if anything happened to Vardu and Ras, whether their robotlike soldiers would continue to fight."

Sam uttered an exclamation. "Of course!" he shouted. "You've hit upon the only possible chance, Beltan. Come on; Dag's our man!"

Hunched over, ducking involuntarily every time new disintegrating blasts smothered against the half-wrecked city, they sped back along the corridor. Sam's knuckles bruised themselves against the quartz door of the chocolate-colored man. "Let us in, Dag," he yelled.

But Dag could not hear. The clamor of explosive sound and the thickness of the walls prevented that. And his eyes, though they stared placidly at the gesticulating men, betrayed no awareness of their presence.

In a fury Kleon thrust his javelin against the quartz. It rebounded with a clang. Sam said exasperated: "The damn fool! It's for his own good as well as ours. He's mad!"

"Not mad," remarked Beltan. "He's just expressing his individuality. Hundreds of generations have inbred his traits." Very carefully he lifted his electro-blaster; very carefully he aimed it.

Blue bolts sizzled against the wall; cut through as though it were so much butter. As the segment fell inward with a crash, he stepped through.

Dag looked up without a quiver; calmly he turned his little disk. The Olgarch said just as calmly: "Do not touch that knob, Dag. First you must listen to what I have to say."

The little fat man stared unwinkingly at the electro-blaster, saw Sam Ward's gun trained square upon his paunch, observed Kleon's javelin poised for a mighty thrust—and sighed. "Why have you disturbed me? By this time I would have sent a hundred more crashing to the earth from which they sprang."

"Even if you killed ten thousand," Beltan pointed out, "there would be still enough left to disperse all Dadelon into its primal atoms. There is only one possible way to defeat the horde."

"What is that?"

"Do you see the great ship that so far has taken no part in the attack?"

"Yes."

"On board are the two leaders and co-conspirators—Vardu and Ras. If you could turn your gravity-intensifier upon that ship, and send it weighted to destruction, the dismayed Hargians would scatter and flee."

Dag digested that. While he digested, a huge segment of Dadelon split off with a roar and went toppling and spinning down. Within that section were Tek and the shovel-handed girl.

"By Zeus!" Kleon snarled. "If you wake not from your dreams, I'll stir you with the javelin tip."

Dag paid no heed to the Greek. With the utmost deliberation he turned to Beltan. "There is truth in what you say. Please step from my path."

The Olgarch obeyed, but Sam held his gun warily on the man. There was no trusting these unaccountable eccentrics.

DAG turned the face of his disk toward the great rocketship. Lines of shimmering force sprang out in long, sweeping curves.

Sam whirled to see their effect. They hurtled through the quartz envelope, sped out into space, converging on the motionless ship.

Then he groaned. For even as they converged, an answering shimmer lifted outward from the craft.

"The thought screen of Ras!" he husked.

Swiftly the screen of interlacing thoughts, impalpable as finest gossamer, yet stronger than the strongest stellene, expanded to meet the converging menace of the multiple gravity.

There was impact!

At the point of impact, cherry-red glowed suddenly like a blazing nova. The hurtling, rocket-sheathed warriors swerved desperately from the interclash of titanic forces. The stage was cleared for a battle of giants.

But the battle was over almost as soon as it had started. Momentarily the thought screen had staggered as it hit the lines of force; then, slowly but surely, it moved outward. The flaring spot turned darker in color; spread and faded into oblivion.

Dag sat, staring. His pudgy hand pressed heavier and heavier on the mechanism. "His weapon is superior to mine," he said simply.

"I knew that all along," Sam snapped His nerves were near the breaking point. "If you only had listened to advice, and armed your comrades with a hundred similar ones, you might have fought on equal terms."

"We can only die now," the Olgarch murmured, "without any possibility of fighting back."

The expanding shell of interwoven vibration was picking up speed. Within a minute or more it would envelop the wreckage of the floating city and whiff them all to extinction.

Dag folded his arms over his tubby paunch. He looked like a particularly ludicrous Buddha. There was no fear in his incongruous blue eyes. "Death is but another state," he remarked.

"Another state or no," shouted Kleon, "I do not resign myself to the gods without a struggle."

"What can we do?" the Olgarch asked gently.

The Greek whirled. His javelin lifted threateningly against the impalpable advance of Ras. "Do?" he echoed. "We can—"

Then his body stiffened; his javelin pointed like a setter. "Look!" he cried hoarsely. 'Our rocketplane!"

They had been taken captive at the other end of the city of Dadelon. Three rows of cubicles had hemmed them off from their craft. But now, as they flung around at his cry, they saw what had happened. The whole side of Dadelon had blasted away. The crystal shells made jagged remnants on the edge of eternity. Half shielded in one of the ruining fragments, half hanging precariously out over the void, was the stolen ship of Harg. Only the retaining wall of the corridor blocked them from the craft—that, and a scramble of some twenty feet in near-vacuum over fused quartz and with thirty miles of nothingness beneath.

Exultation hammered in Sam's veins. It was one chance in a thousand, but it was worth taking. Already the weaving shimmer of Ras was perilously close.

"How about Dag?" he asked suddenly.

"He comes with us," the Olgarch said.

But the Dadelonian shook his head. "This is my city. I have lived here all my life; so have my ancestors for thousands of years. I shall not survive its destruction."

"Don't be a fool!' Kleon growled impatiently. "In another few seconds, we'll all be dead. You'll come, if I have to carry you."

"If you touch me," Dag declared, "I'll turn the gravity-intensifier on you. Besides," and for the first time since the appearance of the rocket horde he gave vent to a chuckle, "I find sufficient humor in the situation to justify my death. I have just discovered the supreme paradox. If I go with you, perforce I must swerve my weapon from that strange approach of visible thought; and we all die together. If I remain behind, and delay its progress, you may escape; but I do not. Three curious creatures, monotonous in their sameness, monstrosities, in fact—yet I die that they may live. A

supernal jest!" And he laughed and laughed.

"Clowning even to the last!" Sam exclaimed in disgust.

"No," Beltan rebuked. "He lives, and dies, according to his philosophy. He is a great man, in his own way. Come, while there is still a chance."

They turned and fled down the crystal corridor. Dag still sat roaring and nodding over his own jest, but with his gravity-intensifier rocklike on the expanding shell.

At the end of the passageway the Olgarch flung up his weapon. Blue streams of force pumped out. A section of quartz fused and fell outward with a great crash.

"Take a deep breath," Sam shouted. "It's your last."

A BLAST of air swept down upon them, sucking them, sprawling and struggling for footing, out into the vacuum of space. Kleon tottered on the verge of the jagged wreckage, started to fall into the void. Sam's fingers clutched upon his sword belt, brought him back to safety. A shudder ran through him. Thirty miles was a little too far to drop.

They could not speak. There was no air to carry the sound. And every molecule of breath was necessary to carry them over that gap of twenty feet to the rocketship.

As they stumbled and ran, precariously skirting the edge of nothingness, thrusting every ounce of reserve strength into that last forward drive, Sam felt a medley of strange and frightening sensations.

He seemed to be bloating up; the tiny veins that lay underneath the skin were pressing and cracking. An inward pressure forced organs against ribs; brought suffocating nausea to him. His lungs pumped like bellows, seeking frantically for air that was not staled and heavy with carbon dioxide. He kept his lips tight compressed, and his nose pinched. Once they opened, the precious oxygen would whoosh out and collapse his laboring lungs.

Strangely enough, however, he did not feel cold, though the outer temperature was close to —200° F. That was, he thought with the corner of his brain not taken up with this race against time, because his body heat dissipated here only through the slow process of radiation. Back on earth, under a thick blanket of air, conduction and convection were responible for quick cooling.

That twenty feet was a nightmare. He saw the Greek's agonized, purpling face, Beltan's distorted features. Once he slipped, and Kleon caught him in turn from terrible destruction. Twenty feet —a few steps—a matter of seconds—yet never in his life had Sam felt so close the presence of eternity.

His stiffened fingers caught the edge of the hull, and he tumbled over the side. Beltan and Kleon fell next to him, soundless in that frightful stillness, their bodies swollen with inner distention, their faces agonized with suffocation. Outside, space was a crisscross of stabbing flames, of swarming rocket shapes that dived and loosened new and mightier destructions. The tenuous shimmer of Ras was close to the ragged shell of the doomed city. In another second or so it would contact.

Frantically Sam groped for the button that sent the glassene covering rolling overhead and started the oxygen tanks to pumping. Beltan, his face puffed out of proportion, his eyes half-closed, crawled toward the controls. Kleon fell heavily on his shield, unconscious.

Preliminary flame spurted from the rear jets. The craft shivered in every strut, rolled rather than darted from the ledge on which it had been precariously perched.

Precious life-giving atmosphere filled the hull. Sam gulped great, sobbing

mouthfuls into his poisoned lungs. The terrible inner pressure relaxed. Throbbing veins sank back to normal. Sounds penetrated.

"Look out!" he yelled. "Ras has made contact."

Beltan glanced back swiftly; opened the jet wide. There was a roar of backward gases, a splash of yellow-blue exhaust; the craft lurched forward.

It was just in time. The thin webbing of expanding thought had touched the magneto-crystal structure of Dadelon. There was a terrific flare, an explosion that shattered the hapless city into a million tiny fragments. The outward sphere of incandescent matter swept after them as they fled, licking hungrily on the tail of their flight like bloodhounds on the trail.

The city of Dadelon, poised for millennia against the gravitic thrust of Earth, was no more. Once more the rocket horde of Harg—thanks to their new leader, Ras—had triumphed. Another sector of a lonely world had been wiped out beneath their thundering surge!

Kleon sat up, gulping and stammering like a fish out of water. He shivered. "Give me the solid Earth next time," he breathed hard. "I do not like this trespassing on the domain of the gods. I thought my heart was pushing through my skin."

They were not hurt much. Skin was broken in several places, some surface veins had ruptured, and faces were blotched and reddened; but their total sojourn in near-vacuum had actually been a matter of some five or six seconds—too short a period for disastrous effects.

Beltan, face still purple and puffed, had recovered his calm. He glanced in the visor screen. "Harg has discovered our flight," he said. "They're chasing us."

Dadelon was a minor sun, a congeries of incadescent fragments. A swarm of rocket tubes came like angry bees after them.

Sam grinned painfully. "This was their speediest craft. They'll never catch up to us."

Kleon rubbed his swollen face. "It wouldn't be the first time they tried it—and failed. But where to now?"

Sam Ward's eyes burned on the curving expanse of Asia and farther Europe that rolled dimly to the west. "On and still on!" he whispered through clenched teeth. On, until we find at last that which we must find—a people truly democratic, truly tolerant and wise. Somewhere—I know it—they exist!"

The rocketplane sped on, carrying three men, of diverse races and times, seeking the Holy Grail of Sam Ward's vision.

LIGHTSHIP, HO!

By NELSON S. BOND

LIGHTSHIP, HO!

"Go to the ant, thou sluggard!" mightn't have been such bad advice—if he went to the army ant for the secret of signaling faster than light!

By Nelson S. Bond

Illustrated by Gilmore

A RED light flickered on the galley range. Gunner McCoy didn't see it. Besides him, a cigarette smoldered into ash. He didn't notice that, either. Sturdy, bowed legs that had rolled with the wallow of many a space freighter were now curled tensely about the legs of his chair. Squinting space-blue eyes that had sought the azimuth through many a perilens were now glued to a printed page. Nose buried deep in a copy of the ever-popular *Martian Tales,* Gunner McCoy was once more living, vicariously, the glories of an adventurous past.

The red light pulsed insistently. The Gunner's lips made tiny, breathless motions. His hero was in one hell of a fix *now!* An arm busted. Spacesuit leaking. Perched on the brink of a wasteland precipice; hemmed in by a vengeful horde of red-planet "clippers." His ray gun empty, useless—

There was a sudden bubbling tumult from the electric stove. A hissing, scorching sound. The sharp, overfragrant odor of boiling coffee assailed Gunner's nostrils. He leaped to his feet, startled.

"Damnation!" roared Gunner McCoy.

He jabbed at the switch. The hissing sound subsided into the cheerful chuckling of a boiling pot. McCoy wiped up the mess ruefully, then opened the oven. There were several pans inside. One at a time, he took them out; dumped their contents onto serving platters.

From the galley cupboard he took fibroid plates, and set the table for two. Then he pushed the button that called the control turret above. A metallic voice clacked: "Yes?"

Gunner bawled: "Soup's on, chief! Come an' get it!" Then he retrieved his magazine from the floor; smoothed its wrinkled cover carefully. "Mars!" he grumbled. "Yeah—them was the good old days. Now look at me! Gunner McCoy—short-order cook on a damn lightship!"

Footsteps clattered on the Jacob's ladder. The slim figure of Lieutenant Ki Barlow, S. S. P., hove into sight. A smile hovered upon the young officer's lips.

"What's the matter, Gunner? Grousing again?"

"Aw, who wouldn't grouse?" complained Gunner. "This lightship tendin' gives me the screamin' meemies. Nothin' to do but eat, an' sleep, an' sit all day long. I'm a guy which likes action an' plenty of it. So what? So we sit here for a year an' a half, lookin' at *that!*"

He frowned derisively toward the starboard porthole. Ki Barlow grinned as he, too, viewed the desolate scene.

"It isn't much to look at, Gunner," he agreed. "But somebody has to tend

the Pluto lightship. Think of it from a romantic angle. The farthest outpost of man! The outermost fringe of the Solar System! Why, shucks, man—there are ten thousand men both in and out of the Solar Space Patrol who would give their eyeteeth for this station!"

"Well, I ain't one of them!" declared Gunner flatly. "Give me a berth on Mars Central. Or at the Summer City port on Venus. Or even at Lunar One—" He sighed. "At least, we could see Earth from there!"

The patrol lieutenant said: "You knew what you were getting into when you signed up, Gunner. Why did you do it?"

"Because I . . . I—" Gunner's leathery neck turned a deeper shade of red. His beetling brows contracted, and his eyes dropped. "Aw, forget it!" he growled. "Let's eat!"

KI BARLOW smiled quietly. He knew perfectly well why Gunner McCoy had signed for the two-year trick on the Plutonian lightship. The friendship between these two oddly dissimilar men was one that disregarded stripes and buttons. Five minutes after Lieutenant Barlow had been assigned Solar Space Patrol keeper at Pluto, McCoy had made application for the assistant's post. In the face of such loyalty, it hardly seemed to matter that he had been grumbling ever since.

As they ate, Ki Barlow elaborated on the "romantic" angle of their job.

"You must admit, Gunner," he said between mouthfuls, "that we're doing a great thing out here. Our work is slowly but surely making Pluto habitable.

"When von Pirquet, 'way back there in the twentieth century, suggested the building of an 'outward station,' six hundred miles from Earth, as a means of offering rockets a 'stepping-off place' for space travel, he never dreamed that some day his principle would be utilized in rendering other planets fit for human life.

"Twenty years ago, Pluto was a frozen sphere. Now look at it! Still frozen, yes—but as soon as we constructed the solar mirror, and began turning the concentrated rays of the Sun on its surface, its frigidity began to lessen; its steppes began to melt. In another five or six years, men can come and colonize here; dig wealth from the mines; build new cities, like Mars Central and Summer City.

"Don't forget—there had to be pioneers on other planets, too. There wasn't always a Mars Central!"

"You're tellin' me?" The gunner's eyes lighted in reminiscence. "Gosh, chief, the first time I ever landed on Mars, there wasn't nothin' there but sand, sulphur, an' them damn clippers. I 'member how me an' old Cap Willoughby got into a jam with the clippers. We had to ray 'em for three solid days an' nights before—"

"I know," interrupted Barlow hastily. "Before the rest of the party found you. I've heard about that before. Well, that just proves my point, Gunner. The conquest of a planet requires sacrifice, always, on the part of a few men. And even though we do weary of this monotonous existence, future generations will thank us for our work."

Gunner sighed. "Yeah, I guess you're right. But I'm glad we only got six more months to serve, chief. My supply of magazines is gettin' awful low. If it wasn't for them, I'd go space-batty, sittin' around countin' the rivets in the walls."

Barlow laughed. "Not much danger of you going space-batty, Gunner. That only happens to imaginative people. And if you had one spark of imagination—" Once more he gestured earnestly to the scene outside. "Gunner, doesn't it get you at all—the immensity of the work we're doing? Just think, here in the void, men have built a gi-

gantic duplex mirror. At one time, this mirror thaws tiny Pluto, to make it habitable, and acts as a heliograph reflector to relay an 'All O. K.' signal from here to Lunar One.

"On the Moon, supertelescopes with electron eyes see the beam, and know that the last frontier is being conquered!"

Gunner said: "Have some more beans, chief?"

"AND another thing, Gunner. In addition to lightship duties, you and I have police work to do here. There's always a chance that Red Armitage and his crew will show up in these parts. If they do—"

"Red Armitage," sniffed the Gunner, "is a dead duck—an' you know it! Chief, the Patrol chased him clean out of the System ten years ago. He ain't never come back. An' he ain't never comin' back, neither!"

"I wouldn't bet any money on that, Gunner. Armitage has a fine scientific mind. Had he not turned pirate and outlaw, he would have been one of the most honored men in the universe today. As it is, until we have actual proof of his death, he remains a menace to all organized society."

Gunner McCoy glanced significantly toward the poop-deck ladder.

"Well, I kinda wish he *would* come. There's a nice new long-range gun upstairs I'm itchin' to try out. An' if we ever hear the alarm signal squawkin', there'll be plenty of time for me to bust that black ship of hisn into a bunch of metal asteroids."

"Here's hoping," said Ki Barlow seriously, "you'll never have occasion to try your marksmanship, Gunner. But I see what you mean. Life must get pretty tiresome for you—with nothing to occupy your time. After all, I have my new signal system to keep me busy."

Gunner said: "Yeah, chief, how's that comin' along? You gettin' anywheres with it?"

"I'm getting nowhere—fast," admitted the officer.

"How come?"

"Well, maybe it was a crazy idea from the beginning. Smarter scientists than I am established the fact, more than two hundred years ago, that the maximum velocity of light is 186,000 miles per second. But somehow I had it in my head that I might work out a means whereby—"

Gunner grinned. "O' course, the professionals—the big scientists—figured it was too tough a problem to work out, but—"

Barlow admitted it, ruefully, but stubbornly added: "Sometimes a problem you can't get the answer to straightforward you can nip by coming up behind, so to speak. The properties of space just happen to be such that light travels at the highest speed possible—186,000 miles a second, the speed of electrical and magnetic pulsations in space. Matter's electrical, basically, and if it tried to go faster, it wouldn't be able to because it would run away from the electrical charges that make it. Now, if you have a rowboat of such properties, you can row it five miles an hour, and you can get from town A to town B at ten miles an hour, if you can find a stream going the right way at five miles an hour. But that won't work with matter at light speeds. If you have a ship going 100,000 a second, and it fires a shell going 100,000 a second faster than the ship—the shell still doesn't go more than 186,000 a second."

"That," said Gunner, "is what you said last time you were dreamin' out loud, and I still think your arithmetic's lousy. No, wait . . . I know. Fitz-what's-his-name and x's and c's and so forth, but never mind. The only thing I can see is that you can run free in space without friction—coast the way we do—so long as you don't hit up too fast. Like the low-range and high-range

planes. Planes for 500 miles an hour and less are streamlined to slip through the air. At 500, the air suddenly acts different, and they plow along as though they were flying through a brick wall.

"In space, you can coast easy, till you hit the speed limit, then—bango! We haven't got a high-range space plane that'll beat that limit, and you're trying to make one."

BARLOW grinned. "All wrong—but the effect's the same. Only I've given up trying to throw a ship that fast—I just want to telegraph or phone a message. We need more speed in interplanetary communications."

Gunner asked, "Is that necessary, chief?"

"Not necessary, but desirable. Pluto's orbit varies between 4,500 and 2,700 million miles from the Sun, Gunner. That puts us a long way from Earth; from Mars Central; or the Moon. Our messages to Earth require approximately six hours to travel. If we could find some method of transcending the speed of light, we would be in closer and swifter contact with 'home.'"

"Well, there ain't no danger in not bein' able to, is there, chief?" asked Gunner anxiously.

"No danger; no. Because, you see, even if anything did threaten Earth from outer space, we could warn Earth before it could get there. Earth's military defenses are organized so efficiently that they can throw a protective field of force around the entire globe in a little less than two hours.

"The problem, Gunner, is a theoretical one with no great importance. But I'm just stubborn enough to want to lick it. I've got enough power and enough equipment up in the turret to jam the ether with messages. But I can't find a way to bust through that limiting factor."

Gunner said: "Well, it's your job, chief. I can't even understand you, let alone help. But I *can* wash these damn pots an' pans. So—"

It was then that it happened. A wild alarm burst from the brazen throat of the electric warning system. The two patrolmen stared at each other for a frozen instant. It was Gunner McCoy, a gigantic grin on his face, who leaped into motion first.

"Raiders!" he roared delightedly. "By Jupiter—me an' Sally's gonna see action at last! Let's go!"

Like a bandy-legged little monkey, he scrambled for the Jacob's ladder.

BOTH MEN hit the control turret at the same moment. Gunner McCoy dived instantly for the jacket of his cherished long-range gun; began to tear off the canvas with eager fingers.

"Give me a bearing, Ki!" he pleaded frantically. "Just one little bearing on them babies! I—"

It did not even occur to Lieutenant Ki Barlow that Gunner had abandoned the formality of commissions in this hectic moment. He was already swinging the perilens 'scope in a wide arc; scanning the star-studded heavens beyond. Once he made the circuit. Then again. His eyes widened.

Gunner begged: "Hurry up, Ki! Sally's achin' for a shot at them monkeys!"

Barlow said in a strange, choked voice: "Cover up, Gunner."

Gunner said, *"Wha-at?"* in a grieved tone; then let his hand fall away from the controls. "Cover up? Hell, is it a friendly ship?"

"It's no ship at all!" answered Barlow in a puzzled voice. "There's nothing in sight. Not even a meteor. It was a false alarm. There must be something wrong with the warning system, Gunner."

"Damnation!" said Gunner McCoy. Then he frowned. "Look, chief—they ain't nothin' wrong with that there alarm

system. I went over it just last week, an'—"

He paused then, shocked. Both men heard, at the same moment, the inexplicable sound. The sound of hands clawing at the air-lock door; the sound of the lock wheezing asthmatically.

Gunner gulped, "Hey, what's *this?*" and jumped once more for the ladder. Ki Barlow was close behind him. They hit the galley, threw open the door to the companionway, and streaked for the air lock—

Then:

"I would advise you, gentlemen," said a cool, mocking voice, "to raise your hands—and keep them there!"

A half dozen spacesuited figures stepped from the door of the air lock. The foremost of these held pointed at the lightship keepers ugly-snouted ray guns. The one just now emerging from the air lock, the one who had spoken, was unfastening his headpiece. Now, as his aquiline features appeared from beneath the quartzite sheathing—

"Armitage!" gasped Ki Barlow. "Red Armitage!"

The space rover smiled. "It is pleasant to know," he nodded, "that one is still recognized. After all these years. Yes, gentlemen, I am Red Armitage."

Barlow's jaw hardened. He said roughly: "What do you want here, Armitage? You know, of course, that you are committing a criminal offense? Entering a lightship without permission from the Patrol?"

Armitage said negligently to a follower: "Disarm them!" Then, after the man had removed the ray guns from the patrolmen's harness: "You may lower your hands now. I am afraid, gentlemen, this is not the first time I've been guilty of committing a 'criminal offense.' Without danger of paying the penalty, I might add."

Barlow fumed: "You'll pay the penalty this time, Armitage! You can't get away with this. Every lightship in the galaxy is on the lookout for you. They'll catch up with you sooner or later. And when they do—"

Armitage smiled.

"Tut, my friend! Let us not waste time talking nonsense. Catch up with me? But of course! You had your opportunity to do so, didn't you? I presume you have an alarm system on this ship?"

BARLOW began hotly: "We have an alarm system, yes! And we—" Then he stopped, his mouth remaining open. His eyes were suddenly perplexed. It was Gunner McCoy who next spoke.

"Hey, Armitage," he demanded, "how the hell did you guys get in here without touchin' off the alarm sooner? The damn thing's supposed to give warnin' if anything's within half a million miles."

Armitage looked at him approvingly.

"Here's a man after my own heart," he said. "There is virtue to the way you get right down to fundamentals, my friend. The answer is—your alarm system worked perfectly. It sounded as soon as we entered its range."

"Huh?" said Gunner. His eyes roved uneasily. Then he forced a smile. "Oh, yeah. I see!" But he didn't see. Out of the corner of his mouth, he whispered to Ki Barlow: "Let him have his own way, lootenant. He's space-nutty!"

Barlow wasn't so sure. He said hesitantly: "Did I understand you right, Armitage? Do you mean—"

Armitage interrupted him brusquely. "We won't go into that, lieutenant. I have other things to think of. It has been some years since I have been inside the Solar System, and I need an up-to-date chart. You have one in your control room?"

Barlow said stubbornly: "No!"

"You lie, lieutenant," smiled the raider. "But you lie like a gentleman. Of course you have one." He gestured

to one of his men. "Wainwright, you know what we want. Go up to the control turret and find it. Hurry!"

The man said, "Yes, sir!" and brushed past the two patrolmen. Gunner glared at him as he passed, and contrived to dig an elbow into the man's side. It was a senseless bit of spite work. The outlaw's fabricoid spacesuit merely bellied gently for an instant. Armitage chuckled.

"Gallants of the Space Patrol! As courageous as of old—and as stupid! Well, we shall soon put an end to your domination, my stellar policemen!"

Barlow said: "Why do you want a chart of the Solar System, Armitage? Returning to your old game? Piracy?"

"I don't know that it's any of your business, my friend," replied the scientist-pirate, "but it won't do any harm to tell you—now.

"Yes, I am returning to my old 'game.' But now I am prepared to operate on a grander scale. My first prize this time is to be—Earth itself!"

"Earth!" Barlow stared at the man in astonishment. Then he snorted derisively. "I guess McCoy sized you up from the beginning, Armitage. You *have* gone space-nutty!"

For a second, the outlaw's eyes flamed with anger. His hand edged toward the gun in his belt. Then he smiled, but there was little mirth to his smiling.

"You are wrong, lieutenant, as you shall discover shortly. Red Armitage is not given to vain boasting. I *am* going to take Earth. Just as easily as I took this lightship."

There was purpose in Barlow's continued taunting.

"I get it. The great scientist has discovered how to crack through Earth's protective field of force? Swell stuff, Armitage! Only the Earth fleet will see you coming, and ray you out of existence before you get within a million miles!"

An amused twinkle lighted Armitage's eye.

"You jump to false conclusions, lieutenant. I will not be rayed. Nor will it be necessary for me to crack the Earth's field of force. For Earth will not see me coming—until I have already landed.

"Earth *can* be taken, as you know. The surprise of my arrival, coupled with the destruction of a few key spots, will assure me the victory I have planned. And then"—the outlaw's eyes glinted—"my mastery of the galaxy will begin in earnest!"

GUNNER'S squinting eyes grew even narrower.

"You must be plannin' to knock *us* off before you leave here, eh, Red? Else maybe me an' Sally will plant a couple of hot bubbles in you when you take off again."

Armitage drawled: "You're rather a reckless fool, my friend. What's your name?"

"Gunner McCoy. *Mister*, to you!"

"Ah, so? I have heard of you—*Mister* McCoy!" Armitage laughed delightedly. "I rather like your spirit, my man. How would you like to join up with me?"

Gunner said: "I ain't your man. An' as for joinin' your crew—I'd as lief play ring-around-a-rosie with a lot of Venusian stink kitties. Which is about three times as smelly as an Earth skunk—if you get what I mean."

Armitage paled dangerously. Once more his fingers sought his belt—then fell away again. In a rage-stifled voice he said: "I understand perfectly, McCoy!" He looked up as Wainwright clumped down the passageway. "Ah, did you find it, Wainwright?"

"Yes, sir."

"Give it here!" Armitage tucked the chart into an open belt flap; motioned his men toward the air lock. "Our work is finished here, gentlemen. I

leave you here to carry on the reclamation of Pluto. At the present time, I'm afraid I can't spare any of my own men. But after we have gained control of the inner planets—we will be back!" He glared at Gunner as he spoke the last words. The Gunner, ignoring General Order No. 13, spat on the floor carelessly.

"O. K., redhead," he sniffed. "I reckon that means never. 'Cause you ain't comin' back."

The other men had gone through the air lock now. Armitage backed toward the gaping entrance, his fingers on the control button.

"Farewell, my friends," he gibed. "We shall meet again, in a few weeks or months. I—"

He got that far. Then something catapulted from behind Gunner at rocket speed. It was Lieutenant Ki Barlow, and as he dived, he roared:

"Grab him, Gunner. Grab him!"

Barlow's body met that of the outlaw with crashing force. Armitage staggered backward, his hand clawing after his ray gun. McCoy saw the movement; flung himself forward hastily. But not soon enough. He felt a lean, sinewy arm worm out of his grasp; felt a bolt of searing flame blast floorward past his scalp. The stench of scorched hair was sharp in his nostrils. Behind him there came a hoarse gasp of pain; the sound of a body falling.

Armitage's leaded boot rose, kicked. Gunner went lurching backward, doubled in the middle. His eyes rolled in his head. There was a greenish cast to his face. He felt a weak desire to be sick, right then and there. Then he saw the prostrate body of his friend and superior officer on the floor. He struggled to his feet, trying to beat off the waves of rolling nausea that surged over and through him.

Armitage's voice fought its way into his consciousness.

"Stand back, McCoy! Stand back or, by Jupiter, I'll blast you!"

From the floor, Ki Barlow gasped: "L-let him go, Gunner!"

Gunner halted; held his crouching posture. There was death in his squinting eyes; death for the pirate if he could just get his hands upon him.

Armitage was snarling: "Now I *promise* I'll be back to take care of you two fools! Watch for me!"

Gunner gasped: "You'd better make it *now,* Armitage! If you don't, you'll never get another chance. I've got a gun upstairs that—"

"That's one reason I'm letting you live now, McCoy. So you and your precious lieutenant may have a preview of what is going to happen on Earth. Go to your gun. Better yet—go to your perilens and watch us off! Perhaps you'll see something to interest you!"

He stepped into the air lock. Then, as if an afterthought had struck him, he stuck his head out for one final, sneering taunt: "You will be interested to know, lieutenant, that our rockets are timed to fire at intervals of one second!"

Then he was gone. The air lock clanged behind him.

KI BARLOW raised himself to one elbow. His face was gray with pain, but there was feverish eagerness in his eyes. He gasped: "G-get me up, Gunner! Get me over to the porthole!"

Gunner bent over his friend solicitously. "Lie still, Ki! Wait till I get something to put on those burns. Where did he get you?"

"On the legs. It's not bad. But I can't walk!" Barlow fought to lift himself; then dropped back, moaning. "I can't make it, Gunner. Go to the porthole. And tell me what you see!"

Obediently, Gunner raced to the porthole. "They're taking off," he reported. "Now they're blasting out with the first jet. There go the others, and they're

swinging out into the Earth-Sun axis. They're beginning to accelerate—"

"N-never mind that!" gritted Barlow. "Watch the rocket flares. He mentioned those particularly. He must have meant something. Time the frequency of the flares!"

Gunner begged: "Lemme go up an' take a shot after them, Ki! I gotta—"

"Time them, blast you!"

Gunner glanced at his wrist watch. He said, in a stupefied tone: "Jumpin' meteors, Ki, they're acceleratin' like Billy-be-damned! I can hardly see 'em already! Now they look like a dot in the—"

"The jets! The jets!"

"He said they was a second apart, didn't he?" Gunner demanded in an aggrieved tone. But he moved from the porthole to the lower chamber's periscope; spun the instrument around and fastened it on the disappearing spaceship. "I guess he oughta know what— Hey, Ki! Goddlemighty!"

Barlow shouted: "What? What do you see?"

Gunner's voice was awed. "He's blastin' off with all four jets firin' simultaneous! They ain't no pause at all between blasts!"

"Not at all, Gunner? Not even a *flicker?*"

"No. An' he's disappearin' so fast that I— Wait! There, I just seen them jets flicker for a fraction of a second. Now they're all blastin' at once again!"

He turned to his friend. "What's it mean, Ki? Has the damn outlaw invented some way to build up speed by usin' all his jets together, instead of staggerin' 'em?"

There was a new look, now, on the face of Space Patrol Lieutenant Ki Barlow. It was a look of horror that overcame the pain which had been there before. There was fear in his eyes. His voice, when he spoke, was hollow.

"Worse than that, Gunner! He's discovered the way to gain maximum acceleration; maximum speed. His ship must be traveling at almost the speed of light. Only a fraction less than 186,000 miles per second!"

GUNNER roared: "Damnation! Then what are we waitin' for? I gotta get a message off to Earth right away; warn 'em he's comin'!"

Barlow said wearily: "Never mind, Gunner. It's no use. Now I see why Armitage didn't take the trouble to kill us. He wasn't afraid of our gun. And he knew that our attempts to warn Earth would be useless."

"Useless?"

"Yes. Because *he* is traveling as fast as any message we might send. Even if we sent it right now, it would get there *after* he did."

"Hell's bells!" Gunner shouted.

"That's why he was able to pierce our defense zone," said Barlow. "He was traveling just as fast as the warning itself."

"You mean," Gunner said, "the warning operated the minute he entered the half-million-mile zone?"

"Not the minute, Gunner. The *second!* Armitage's ship touched off our warning approximately three seconds before it landed here at the mirror. But the ship, traveling at the speed of light, arrived at the same time as the warning!

"That's what will happen on Earth. His attack will be a complete surprise. He will be sighted—yes! But he will land at almost the same time he is first seen. There will be no time to throw up the defensive field of force."

Gunner groaned: "Chief, I don't get it. How could you figure that just from seein' his flares?"

"By that Lorentz equation I told you about before, Gunner. A second in time in a system which is moving with the velocity of light appears infinitely long to a stationary observer—which we are,

relative to Armitage's flight. His jets are, as he said, blasting at intervals of a second each. But to us, viewing them from here, we see but one blast, which appears to last forever. Only the fact that you *did* notice a tiny flicker indicates that he has not quite attained the speed of light."

Gunner said suddenly: "But, chief—he's contracted, like you said before?"

"Yes"—wearily. "And that only makes it worse. His ship has, as far as we are concerned, contracted to a point which approaches infinity. That makes it harder to spot him."

The Gunner snapped his fingers.

"Well, hell, what are we worryin' about? If he an' his ship are contracted like that, they're all squashed to death by now, ain't they?"

"Not at all, Gunner. You see, they comprise a system of their own, now. Inside that system, everything still appears normal. They see the outside universe as the contracted unit; outside time as being infinitely slow. Inside their own boundaries, life goes on quite normally."

"Then . . . then what can we do, chief?"

"Nothing, I'm afraid. Armitage will make good his boast. He was right—Earth *is* vulnerable to the man who can get through that explosive field of force. There's going to be a new dictator on Earth, Gunner. The first in more than a hundred and fifty years."

"Which puts us," said Gunner gloomily, "behind the eight ball. There was an evil look in that redhead's glims when he said he'd see us later." He rose and hunched powerful shoulders. "Well, if we can't do nothin', we can't do nothin'. But let's get them burned legs of yours fixed up, before Armitage comes back to burn 'em off again."

He turned his back to the lieutenant, squatted low. "Climb on, chief. I'll carry you up to the turret an' give you some first aid."

Ki Barlow squirmed onto his assistant's back. He was still muttering as Gunner bore him down the passageway: "If only I could have perfected that invention of mine. I said it had no practical value, Gunner. But here's a spot where—"

They reached the galley and the Jacob's ladder. Gunner reached for the rungs. "Up we go!" he said.

At the fourth rung the Gunner was panting. At the seventh he was sweating. When they reached the topside deck he dumped his superior officer unceremoniously off his back and puffed: "Hey, you ain't no lightweight! That piggy-back stuff is slow business. What we need in this dump is an escalator!"

Barlow smiled wanly. "I guess so, Gunner." Then suddenly his eyes jolted open wide. "What?" he demanded. "What's that you said?"

"I just said—" began Gunner again.

But Barlow didn't listen to him. The lieutenant was crawling on his hands and knees over toward the desk he used as his workbench. There was a strange, wild look in his eyes as he pawed through drawers for paper and pencil.

"Never mind!" he shouted. "I know what you said. Piggy-back! Escalator! Gunner—to hell with these legs! I've got an idea! The clue I've been looking for! There's a chance to lick Red Armitage yet!"

GUNNER said meekly: "Chief?"

"Yes, Gunner?"

"Say, chief—if you're done now, how about lettin' me fix up them feet? Don't they hurt?"

Lieutenant Ki Barlow's shirt was plastered to his back with perspiration, but there was a smile on his lips. He said: "O. K., Gunner. I guess they do, but I've been too busy to think about them. Come ahead. I can slap out this message while you do it."

"Sure, chief," said Gunner in a re-

lieved tone. He went to the medicine cabinet.

For the past half hour the control turret of the lightship had been a scene of hectic activity. For a short time, Lieutenant Ki Barlow had scribbled wildly, a series of cryptic calculations that Gunner did not even pretend to understand.

His figuring finished at last, Barlow had started snapping swift orders to his assistant. Uncomprehending as to the reasons for his actions, Gunner had blindly obeyed in wiring, welding and soldering together bits of the equipment which had been parts of Barlow's previous experiments.

Under his fingers, a curious maze had come into being. Over this, now, Barlow was fussing like a mother hen. His hands were making a few final adjustments. Now he was arranging, for transmission in the special Space Patrol code, a message. He hooked in a telegrapher's key to his singular instrument; then started pounding.

As Barlow's fingers jabbed the wabbler, the Gunner bathed and dressed the officer's seared limbs. The wounds, Gunner found to his deep satisfaction, were not as serious as they were painful. Within a few weeks, only white scars would show evidence of Armitage's visit.

Barlow finished tapping; closed a switch; leaned back in his chair.

Gunner grinned up at him. "Feel better, chief?"

"Much!"

"Gunner said: "Good! Then maybe you'd like to tell me just what the merry blue hell we was doin'?"

"What *you* were doing, Gunner. You did the work."

Gunner snorted. "Yeah. So does a robot do the work. But it doesn't know what it's doin'."

"Well, you deserve more credit than that, Gunner. For in this case, you even supplied the idea."

"Who . . . *me?*"

"Yes. When you made that crack about the 'piggy-back' and the 'escalator.'

"You see, Gunner, all the time I've been trying to invent a method of translating swifter messages to Earth, I have been utilizing a stupid 'piggy-back' principle. I had some vague idea of sending out a double electrical current, and making the first 'carry' the second.

"It was no good. I was just 'putting the electric current on piggy-back.' When one man carries another on his back, their combined speed is only the speed at which the bearer's feet move over the ground. My superimposed current was merely being carried by the primary—which didn't provide a path for it."

"So," said Gunner, "the escalator?"

"That," explained Barlow, "was the tip-off. When a man walks up an up-moving escalator, he gets the combined speeds of his own movement and the escalator. That was the principle you suggested to me. I should have thought of it myself. It is the principle of group velocity.

"Group velocity is encountered in many phenomena of X rays and diffractions. It is, in effect, a signal sent down a pre-existent series of light waves. You can send a signal down a string faster than you can throw the string. You can signal down a length of wire faster than you can carry the wire. So —you can signal down a beam of light, utilizing this"—Barlow tapped the instrument before him—"which you might call a 'group-velocity modifier,' faster than the velocity of light. Do you get it?"

"I'm gropin'," confessed Gunner. "But—how about the carrier. The . . . the escalator, you might say?"

"Out there!" said Barlow.

Gunner stared out the indicated porthole blankly. "Pluto?" he hazarded.

"No, Gunner—the mirror!" There was elation in the lieutenant's voice.

"To superimpose my secondary waves on a medium with the speed of light, in order to exceed the speed of light, I first had to *have* a primary—a constant, uninterrupted light ray to Earth.

"And the mirror is—just that! Its heliographic beam is continuously in operation, because the Sun is continuously in operation, and for years Lunar One has been receiving an uninterrupted light beam from the mirror.

"The established light beam from the mirror to the Moon is my carrier. Over that bridge, my message to Earth is now traveling at a rate which will approach twice the speed of light! Approximately 372,000 miles per second!"

Gunner gulped. He said faintly: "Ki . . . how soon will we know if the damn thing works? An' have you got a cigarette?"

Lieutenant Barlow handed over his pack. "We'll know," he answered soberly, "in six or seven hours—"

THE radioman at Lunar One lolled back in his chair. It was a lazy day. His shift would be finished in another hour. He began to plan for his period of freedom. Back to barracks for a cooling shower. Then maybe a few rounds of skeet down at the Young Officers' Club. A set of tennis at the 'Drome—

He caught the sound of footsteps outside and came out of his dream suddenly. That would be Old Nosy, the O. D., making one of his snoopy inspections. He snapped on his receiving unit; began spinning once around the dial to look busy in case the door should open.

The door did open. Old Nosy's head came popping in suspiciously.

"Anything new, Sparks?"

"No, sir," replied the operator. "Nothing on the air but—" He stopped suddenly, his eyes widening. Then his fingers leaped to the control board, slapped the power up to max. He shouted: "Hey!"

Old Nosy stepped all the way into the room. The O. D. knew nothing of radio transmission, but he *did* know that something unusual must be happening to make Sparks act this way. Code signals were spluttering and whining through the room. The meters were hopping on the instrument panel like wild things.

"What is it, Sparks?" yelped the O. D. "What is it?"

"Shut up, Nosy!" roared Sparks recklessly. His fingers were crawling across a sheet of paper at lightning speed. "These damn signals are coming in so fast—" The message screamed to a close. Sparks looked at it with horror in his eyes. Then he rammed open the Luna-Earth control and started bawling at the top of his voice: "Emergency call—Luna to Earth! Clear all lines! Clear all lines! Luna to Earth calling! Luna to Earth call—"

Force Engineer O'Hara, New York Local, saw the red light glowing before his eyes. He plugged in and crisped: "New York Local! Go ahead, please!"

A voice spoke swift commands. Engineer O'Hara's eyebrows tried to crawl into his scalp. But his voice did not vary an iota. He repeated, woodenly: "All units on immediately. Very good, sir!"

He reached forward and closed the switch in front of him. Current rose and hummed, securing New York area in a missileproof field of force. At the same instant, in tenscore other locals, tenscore other hands leaned forward to close switches. Earth became a ball incased in a quivering sphere of energy—

In the control room of his spaceship, Red Armitage glanced at his wrist watch. A thin smile lingered on his lips. He said to his pilot: "Three more seconds!"

"Three seconds! Yes, sir!"

Armitage turned to a companion. "The men have their instructions?"

"Yes, sir."

"Very well! See that they obey them." He turned once more to his wrist watch. The smile deepened. A dream of world empire, of universal empire, was very near.

"The exile," he mused, "who became emperor! It shall soon come to pass!" Then, to his pilot: "Cut power in one more second!"

"Yes, sir," said the pilot. "One more sec—"

That was all. There was a sudden, brilliant, coruscating flare of light in Earth's domain. For an instant the sky flamed with fingers of gleaming light. Men looked up—and wondered briefly. Then they went on about their daily work. Few realized that far above, in the troposphere, where Earth maintained its protective shield of force, a dream of world empire had shattered into a million burning fragments—

ON THE lightship beyond Pluto, two men sat listening breathlessly as the radio message from far-distant Earth came winging across four thousand million miles of space. The message came in code, but as it came, Lieutenant Ki Barlow translated it for the benefit of his assistant.

"—anxious to learn more," the message concluded, "about your new invention which prevented this disaster. A Space Patrol cutter is being dispatched immediately from Io to Pluto. Upon its arrival, you will transfer your post to Lieutenant James Faragon, and proceed at once to Earth. On behalf of the entire Solar System, we hereby commend you on your brilliant endeavors—"

Ki Barlow said: "And so on, and so on! Gunner, you old grouser, you and I are big shots—for a while! And, pal, it's Mother Earth for us! How do you like that?"

Gunner fidgeted. He said: "Lootenant . . . they said *you*. But does that mean me, too?"

Barlow said sternly, "Where *I* go, *you* go, you old gun monkey!"

Gunner McCoy sighed contentedly.

"In that case," he said, "O. K.! Chief, did I ever tell you about the time me an' Joe McGurk was attacked by a bunch of Rollies on the sun side of Mercury?"

"You did," said Ki Barlow. "Many, many times—"

CREDIT

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TOOLS FOR BRAINS

A science-article on the art of thinking by machinery. A machine can have memory, logic, number sense, and an ability to do superhuman calculus—but it lacks the ability to say "That's plain cockeyed!"

By Leo Vernon

Illustrated by Schneeman

CAN machines think? The question keeps coming up every time a new kind of calculating machine is invented, or a new attachment is put on to the almost unbelievable machines that are now being manufactured. Unfortunately for the mathematician and physicist, the question must be answered, "No."

There is a big difference between a machine that can think and the awe-inspiring new analyzer being built at Massachusetts Institute of Technicology. This new machine can correct errors, will even flash a light to point out the place where an incorrect adjustment has been made, but it cannot by itself decide which is the better of two sets of figures or do anything except what the operator has decided for it to do.

A calculating machine does not *know* the answer to 3 + 5, as a thinking machine would. The human operator puts the number three in the machine, and then puts in the number five. The machine adds the number 1 five different times, and stops. A more complex machine might add something other than unity, such as trigonometric functions, but essentially it makes use of only those things which were put in the machine and shows no choice.

The important thing for scientists is that the machine can add 1 five times, or it can add 14,689,378 some 8,564 times, and do it almost as quickly as the operator can push a button. In more advanced machines it can repeat such an operation a thousand times in an hour for different sets of numbers. It is truly a labor-saving device.

The history of calculating machines shows that labor saving is the important factor. As commerce and science developed and required more and more arithmetic to be done, new machines and methods were invented. In the earliest days all the arithmetic that was needed could be done on fingers and toes, the first calculators. If more than twenty twenties were required, nothing could be done, until one of our cavemen ancestors thought of using pebbles in addition to his toes. Not long after this another labor-saving person learned to string beads on twigs, and the first abacus came into existence.

The abacus is our first truly mechanical device for doing arithmetic. When divided into separate wires for units, tens, hundreds, and so on, addition and subtraction can be done very rapidly. Even multiplication can be done by repeated addition, and a very crude division is possible, though not simple.

There were no real understanding of arithmetic as long as the old Roman and Greek numerals were used. The next improvement came with the introduction of the Arabic number system, and the

invention of the number zero. When this system was first learned in Europe, the men who knew it went around and gave exhibitions of how rapidly they could add, subtract or multiply without an abacus.

The invention of the arithmetical symbols +, —, and x gave additional impetus for mathematical advances in the sixteenth and seventeenth centuries. By the year 1600 it was absolutely necessary to find aids for science and commerce. Mathematicians were spending years computing problems that can now be done in days. L. van Ceulen spent his entire lifetime computing the ratio π to 35 places of decimals, completing the job in 1610. The invention of calculus, the discovery of infinite series, meant more and more computing for overworked mathematicians. Increasing commerce and the complicated rates of exchange meant worse and worse problems for the merchants, since coinage was not on the decimal system.

THE FIRST aid came from India by way of Persia, with blocks of wood laid out in the form of multiplication tables. By shifting these tables around, multiplication could be done more accurately, and in some cases more speedily. Then John Napier made his two biggest contributions toward reducing wear and tear on mathematicians. In 1594 he invented logarithms, and in 1617 improved the Persian tables by applying his logarithms to the blocks of wood that were in use.

The logarithms were devices which reduced multiplication and division to addition and subtraction. By applying them to blocks of wood shaped like rulers, two rulers could be laid side by side and the answers read off directly. These rods of wood, called "Napier's Bones," were improved rapidly. Samuel Pepys, author of the famous diaries, had a job requiring him to measure the number of cubic feet in large lots of lumber, a real problem without some devices to help him. Pepys used Napier's Bones, and quickly got the idea of fastening them together in a frame so they could be slid back and forth conveniently—the first form of the modern slide rule.

The slide rule has continued in use, with considerable improvement, up to the present day. For much engineering work and some commercial work it is unbeatable, but for the scientist it helps only in getting a rough idea. The difficulty is that it is accurate only to four figures at the most. With a slide rule it is possible to multiply 1024 x 1728, but instead of getting the correct answer of 1,769,472, the slide rule simply says that the first four figures of the answer are 1769 or 1770. That is, there is an accuracy of a little better than one part in a thousand.

This was not enough for scientists or for merchants. They had to know their answers more accurately. Logarithms helped greatly, especially after Briggs invented the modern form based on the decimal system in 1617 and computed ten place tables for all number between 1 and 100,000. More was needed, and it came soon.

Blaise Pascal, in 1641, made one of the great contributions of his weirdly mixed-up life. In order to help his merchant father, he invented an adding machine. As France at that time had a coinage system of 12 deniers equal to 1 sou, 20 sous 1 livre, imagine the problems of a merchant trading with England and other countries with similarly jumbled coinage systems, and with varying rates of exchange.

Pascal did not use the modern style of key-driven machine, but he invented the mechanism which is used in modern speedometers and calculators. One complete revolution of a wheel causes the wheel next to it to turn over one-tenth of a revolution, and so on for a series of gears. More, he did this at a time when machinery was not known

for cutting gear teeth accurately. He had to use pin gearing. Each wheel had ten holes drilled in its outer rim, and little pins were carefully handfiled to size, inserted in the holes and soldered in place. He even invented the cams necessary to go on the wheel's axle to cause the number to remain in place on the dial until the time arrived for the next number to shift into position.

For years Pascal tried desperately to sell the machine and its basic idea, but without success. It was still cheaper to hire a lot of clerks, instead of mechanics to build machines. A few of his machines were used by scientists, with improvements added by men such as Moreland in 1666 and the great Liebnitz who worked from 1674 to 1691 building the modern stepped reckoner and pin wheel, making the key-driven machine possible.

With these advances of a single century, scientists caught up on their computations and commenced discovering new theorems and equations. By the beginning of the nineteenth century, the problems were again becoming complex. Some men who had a genius for doing arithmetical work, such as Gauss and Euler, devised new methods of computing, simplified formulas, but still work was piling up.

THE NEXT advance came by way of industry, from a weaver, Joseph Marie Jacquard, inventor of the Jacquard loom. When power-driven looms first were made, they were used almost exclusively for straight weaving with the warp and woof alternating very simply. Designs still had to be made by hand, or the power-driven machinery stopped so that the adjustment for lifting the warp could be changed.

Jacquard invented a device to weave any pattern without stopping the machinery or using hands at all. He used something like a player-piano roll. As this tape rolled through the loom, wires attached to the warp would poke up through the holes in the pattern and cause the warp to be lifted, changing the pattern automatically. The design for the cloth could be planned beforehand, holes punched in the roll of paper to correspond to the design, and the machines would take care of it automatically. This method is still in use, as in Jacquard satins.

Charles Babbage got the idea that instead of designs for cloth, equations could be punched in the roll of paper and instead of looms, the roll could be made to actuate computing machines. In 1823 Babbage started construction of his difference engine, but money ran out in 1833 and the machine was never finished.

No new ideas were developed for over half a century. The key-driven machines were improved, and with the addition of electric power became almost magically efficient and speedy. Anybody who has operated a modern electric calculating machine knows the tremendous power it gives in calculating, but even this is not enough.

The sheer volume of computing that must be done in business and science has forced all scientists to think of new developments, and yet better mechanisms. It is hard to appreciate the amount of arithmetic that has to be done. In a single big bank there are dozens, or hundreds, of machines in use constantly. Something has to be discovered to run the machines still more rapidly, and to run several machines at once. It took too many people and too long hours to punch the keys by hand and make records of the results. In a big nation-wide industry, accounting has become more and more complex. Hand-operated machines with typists to tabulate the results cannot handle the volume of work. Machines are needed which take the data, do the necessary calculations, print the results, and store these results to go into other machines.

In scientific work the problem is as

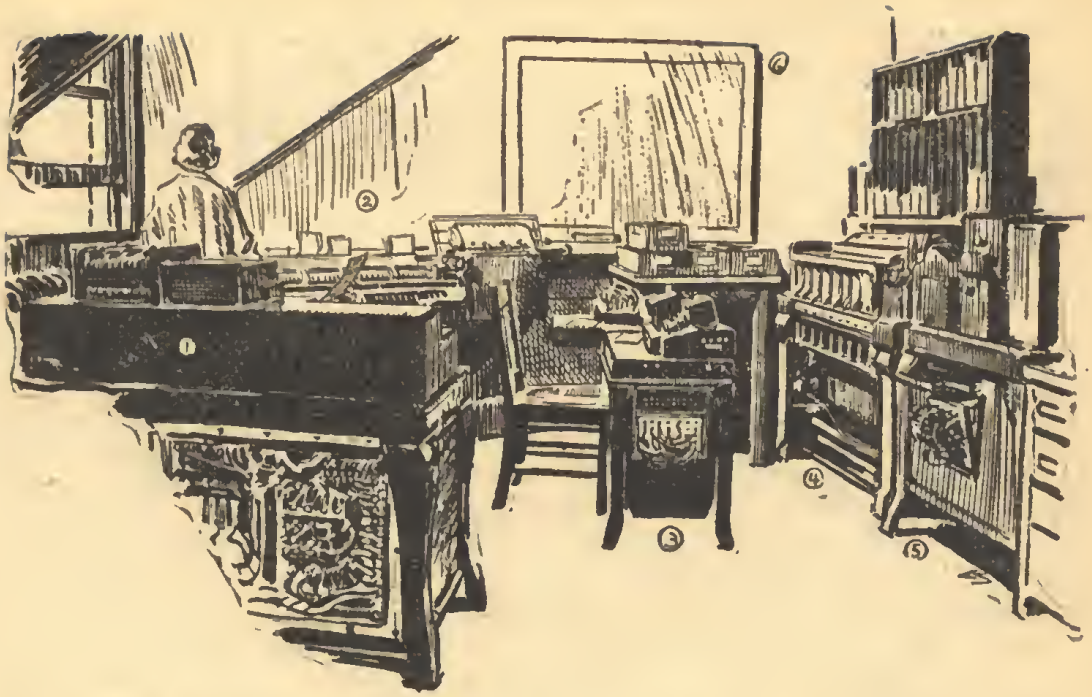


Fig. 1. The astronomical calculating machines used by the Columbia University Department of Astronomy. This apparatus is assembled from various International Business Machine calculating and bookkeeping units, slightly modified for the work of astronomers. The numbered units are (1.) the multiplier, (2.) tabulator, (3.) summary punch, (4.) card sorter, (5.) high speed reproducer, and (6.) blackboard for notes and instructions for workers on the next shift. To this machine, the cards are memory, the sorter the ability to select a given fact from the mass of knowledge in memory, et cetera.

big. One of the best-known problems is the motion of the moon under the influence of the earth's gravitation, the problem which even Newton said "has given me a headache." This problem had to be solved if there was to be accurate navigation and prediction of tides. Using modern types of key-driven machinery, this problem was computed under the direction of Professor Ernest W. Brown of Yale. It was finished in 1923, after thirty years of work.

Cosmic-ray problems, ionosphere research, quantum theory, require the solution of equations so long and complex that entire sheets of paper are required to write a single one. And it is necessary to solve hundreds, or thousands, of such equations. In quantum theory it is common for one man to spend most of his time for a year using high-speed electric key-driven machines to get the answer to one small problem. Many atomic problems require ten or fifteen significant figures. They have to be checked to avoid any error, since an extremely small difference between a computed and a measured value may be of immense meaning in scientific and industrial development.

There are problems now which scientists hesitate to try to solve, just because it would take a lifetime to get the answer. They are forced to use short cuts and do the work less accurately, holding back development in radio communication, television, thermionics, atomic structure (and possibly atomic power) as well as astronomy.

The key-driven machines run as fast as the fingers can be moved. But it is

necessary to make a record of numbers and put them back in the machine by way of the keyboard to do another operation. The machine does not reset itself, or record the results obtained, or correct errors due to punching the wrong key.

Scientists need machines which will punch the keys, record the results, and use these tabulated answers to punch the keys again and still again, doing what mathematicians call iteration automatically. Or else they need machines in which mechanisms imitate complex mathematical operations. These two types of machines have been built within the last few years. The new analyzer at Massachusetts Tech combines principles of both with some of its own, the greatest advance in calculating machinery yet seen.

We can look over the two methods of development and see what machines will do. Then in conclusion, take a brief look at what the new machine will be like when it is finished a year from now, and what a scientist would like to see.

THE first machine is called the punched-card type, since it was found more convenient to use cards instead of long rolls of tape. A card has holes punched in it to represent a single number, or groups of numbers, or even complex functions or other data. These can be fed into the machine which in turn punches other cards. The present form of this machine was first developed by Herman Hollerith to take care of the problems of the census of 1890.

A more recent use of this type of machine with which almost everybody is familiar is in the famous Federal Bureau of Investigation. A card is made up for every individual listed in the files. Along the sides of the card holes are punched in different positions for different types of information, as color of hair and eyes, shape of nose and finger-print classification. Cards are placed in a machine adjusted to remove all cards with holes punched in certain spots. The cards go through the machine at the rate of several thousand an hour. At the end, there may be a dozen cards left, from which to pick the desired identification.

If, instead of sorting, the machine is equipped to take cards in which holes represent numbers, with mechanisms for adding, subtracting, multiplying or dividing the numbers, you have the modern type of accounting machine. There could be a set of cards representing, say, accounts with holes punched to indicate the proper numbers. The machine is set to indicate the interest rate, by which the account is to be multiplied. Another set of cards is punched with withdrawals, and still another set for deposits. Feeding the three sets of cards into the machine, the withdrawals are subtracted from the account, deposits added, and the final result multiplied by the interest rate. The answers are punched on another set of cards ready to be fed into the machine at some later date. At the same time the answers are printed on a tape, with code letters to indicate whose account it is.

It is easy to think of variations that can be performed with straight accounting machines, which do only simple arithmetical operations, such as $A + B$, $A - B$, $AB + C$, $AB + C + D$, $A + B + C$, $A - B - C$, $A + B - C$. These are all done on present-day commercial machines, with the possibility of punching the results on new cards and using these as new values of A, B, C, and D.

An extension of these machines has been built at Columbia University by Professor Wallace J. Eckhart to solve the moon problem mentioned before—the problem that took thirty years to calculate, using ordinary key-driven machines. It took six machines, each as large as a piano. Holes representing the data, or information obtained by

observations, were pushed by hand in some five thousand cards to start with.

Cards were fed into tabulating machines at a rate of seven to eight thousand an hour. Then, from sorting machines they went to adding, subtracting and multiplying machines which punched new cards which in turn went through the machines. In all, about 250,000 cards were punched by the machine. The problem was solved in two years' time, compared to the original thirty years. It was more accurate, and the machine printed the results.

That is what punched-card machines can do now, but they need expansion and extension to do problems in algebra. In addition to the four actions of simple arithmetic, the machine should be built to use positive and negative numbers. It must be able to solve problems with brackets and parentheses, as $(A + B)(C + [B - D])$ which means doing a problem in parts, storing the results, and then making use of the stored results. It should be able to raise numbers to any power, or take any root. It should store and have available logarithms to the base 10 and exponential functions to at least ten figures on both sides of decimal. There should be available in the machine all trigonometric and hyperbolic functions as well as the more complex elliptic functions, probability integrals, Bessel functions, gamma functions and others which are commonly used. That is, the machine should have stored in it the equivalent of many volumes of tables.

It will be necessary to use the machine itself to compute some of these functions, since they are not tabulated accurately any place now to the extent that would be necessary. But think of what can be done with such a machine. Algebraic equations of almost any order can be solved. Any second order differential equation, integrals, complex formulas, can be evaluated and tabulated neatly. The thought of what can be done is enough to make any mathematician or theoretical physicist overjoyed.

There are types of problems, though, which would be awkward even for a super machine such as this. There are two machines now in use at Massachusetts Tech which will solve some of these other problems, as well as many of those that can be solved on the suggested punched-card machine. They are the network analyzer and the differential analyzer, both built on the second principle of use of machinery to simulate mathematical problems.

THE NETWORK analyzer, the more complicated and more difficult to understand, is yet based on more easily understood principles. Everybody who has worked with electricity is familiar with the Wheatsone bridge, a setup for measuring resistance. With an ordinary Wheatstone bridge, it is possible to solve two equations for two unknowns, putting in the constants in the equations as ohms of resistance. Imagine this multiplied many times, with bridges connected and interconnected and capacitances and inductances included. Much more complicated problems can be solved and the answers read directly from electrical instruments. The machine occupies a fair-sized room, with panels on all the walls and a space two or three feet deep back of the panels filled up with wiring and connections. The machine is usually used to solve electrical problems, because it is possible to repeat in miniature all the connections and resistances and power inputs and so forth that occur in problems of power lines. All that is necessary is to plug into any part of the line and read the current, or resistance, or whatever else is required.

The differential analyzer, though, is more general. Particularly, it is designed to solve differential equations, problems that involve rates of change.

It does it by duplicating these rates of change in its moving parts.

The analyzer itself is a machine about the size of the body of an ore-car. Essentially it consists of a set of adjustable shafts and gears with integrators and input apparatus connected to a printing attachment. The rates at which the different shafts rotate represent different quantities in the problem to be solved. It is because of this that the machine is best suited for problems that involve rates of change.

There are connections between the different shafts, gear trains which will cause one shaft to turn at a rate which is exactly equal to the sum of the rates of two other shafts, or perhaps the product of two or three rates or rotation. There are even special gears which will multiply the rotation of a shaft by some special constant such as π or ϵ.

Since backlash in any of the gear trains would cause error, a mechanism had to be invented which would apply negative backlash between any two con-

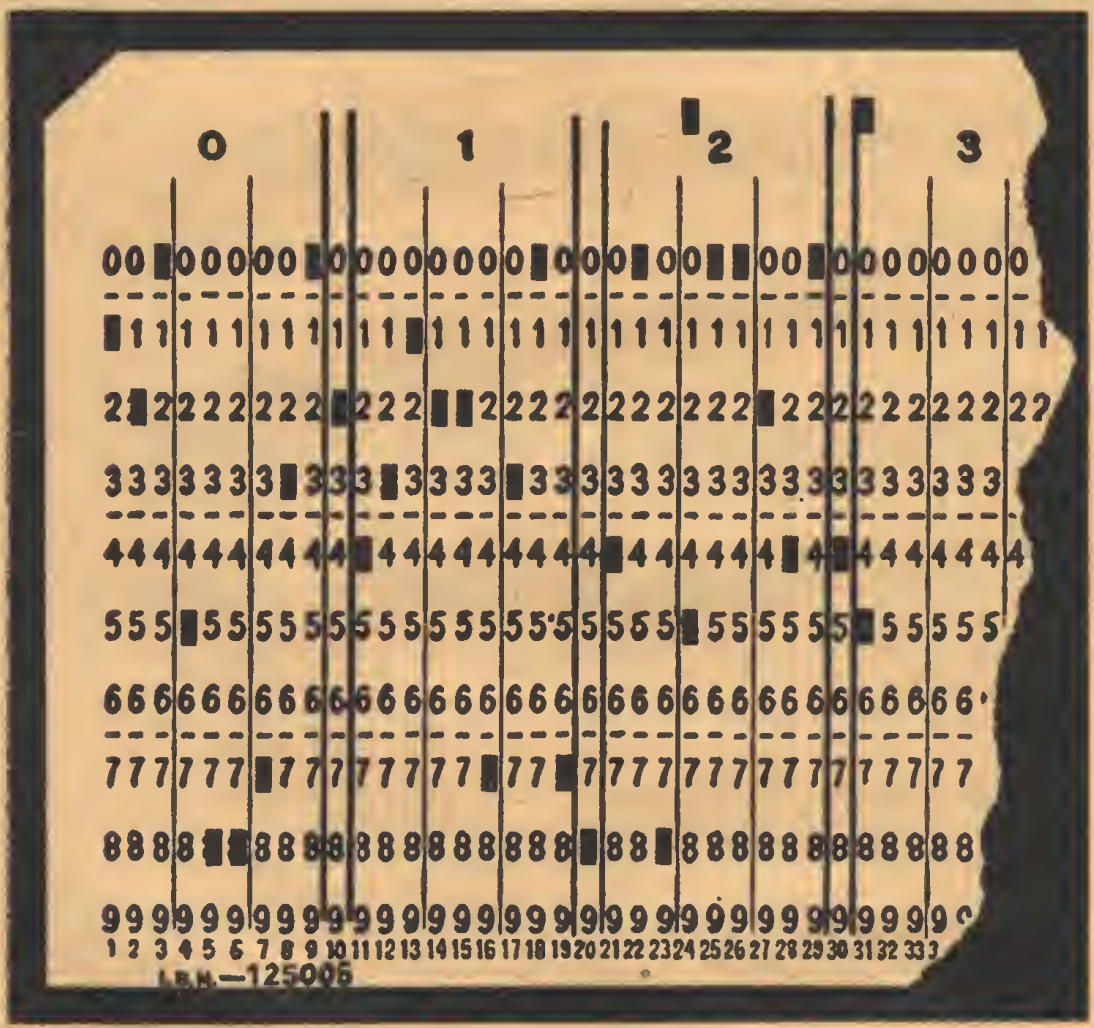


Fig. 2. Typical punched-card used in Columbia's astronomical mathematical machine. This card gives relevant data on a certain star, as follows: Star Number 120-588, an arbitrary designation of the star in the catalog. Since this is a star well below naked-eye visibility, it has never been named. Magnitude, 7.3. Right Ascension: 02 hrs. 43 mins. 12.2 secs. Precession, 3.0784 secs. (of time). Secular Variation, .085 secs. of time). Declination, 00 deg. 24' 04.5".

nections, removing possibility of error in that form.

Integrators, which had been used before for very simple problems, had to be developed for high-speed operation. Each one consists of a flat glass rotating at fairly high speed, and a small metal disk resting with its edge on the plate. The small disk is turned simply by the frictional contact between the two, the rate of rotation changing as it is moved by another shaft back and forth across the diameter of the glass plate.

The little disk has to be light in weight, to prevent inertial lag in changing speed. Its bearings must be smooth enough to prevent slippage when the speed changes quickly, or is high. Yet this little wheel, barely an inch in diameter and mounted on jewel bearings, must drive a heavy half-inch steel shaft with several long gear trains, and be able to reverse direction of rotation. This required the development of what is called a torque amplifier, a device which amplifies the torque or twisting power of this light little wheel ten thousand fold.*

There are, then, three shafts connected to each integrator; one controlling the rotating plate, one the position of the disk on the plate, and the third driven by the little disk. The mathematical connection between these shafts is $u = \int w\, dv$. Roughly, this says that the rate of rotation of the shaft w at any instant of time is multiplied by the amount the v-shaft turn during that instant of time. Further, these products for every instant of time since the machine was set, are added together. The sum of all these is the rate of rotation of the u-shaft.

There are six of these integrators which may be connected and interconnected.

IN THE differential analyzer, instead of giving numbers to the machine, a graph is used. The data is very carefully plotted, preferably on a metal plate which will not change with humidity changes (the room is close enough to constant temperature to avoid heat-expansion errors). The graph is put on one of the input tables, looking like a drafting board, and a cross hair, with magnifier attached to an accurately machined screw, is placed over the beginning of the curve. When the machine starts, the arm carrying the cross hair starts moving at constant speed across the graph. A hand-crank moves the cross hair vertically, through the action of another screw-and-worm gear. This screw controls the rate of rotation of one of the main shafts of the machine. It is the job of an operator to keep the cross hairs accurately on the curve. As there are five input tables, it is possible to feed in five different sets of data at the same time, integrating, multiplying, adding all of these five sets through the six integrators in a bewildering complexity of solutions.

To make the operations easier, each input table is arranged with connections for starting and stopping the machine, and with gear shift levers for three speeds forward and one reverse, so that if one operator loses his place on the curve, or can't turn the crank fast enough, he can always shift. There is also an automatic speed control on the machine itself, and a control board panel with a fascinating array of lights to show which tables and shafts are in operation, which directions they are going, and their speed, with warning lights flashing as speeds approach the maximum allowed.

At one end of the machine is a set of dials like those on a speedometer connected to various of the shafts to register their rotation, recording the various parts of the solution of the problem. These dials can be connected to any de-

* The machine itself is described in detail by Dean V. Bush, who directed the building of it, in the Journal of the Franklin Institute, Vol. 212 (1931), page 447.

sired shaft. In addition, they can be adjusted to print the results of all dials simultaneously at regular intervals, or at any time an operator desires. Still more, the machine can plot curves of two of the results, on the same paper.

In full operation, with five input operators, one person on the printing mechanism, a general captain of the team, and a mechanic standing by, the full complexity of the machine and its great power become apparent.

Just one example of what the machine can do may be cited from problems in atomic theory. To work out the numerical solution of a wave equation for a moderately simple atom, with the equations already written down, may take as much as six weeks steady work with a key-driven, electrically operated calculating machine. On the differential analyzer, once the machine is set and ready to operate, the same results may be turned out in an hour or less with three people working on it.

Still, there are objections to this machine. It is accurate, at best, to one part in ten thousand. This is sufficient for a great many of the problems given it, since the preliminary data has been computed to greater accuracy and the final results of the problem require less. But one more figure would be better. Again, there is a strict limit to the accuracy possible in plotting a graph of data. Also, it sometimes takes several day to adjust the machine and get all the gears and shafts arranged in proper order to satisfy the factors involved in the problem. Then, despite the tremendous saving in time, it is still too slow. Problems have been put on it that, even with its tremendous calculating power, required months to finish. Then these results require more months of study before they are recombined and fed into the machine again. There are so many problems needing solution that it is necessary to wait months to use the machine.

WITH THESE difficulties in mind, and the knowledge gained from building the machine, work was started some two or three years ago on a new differential analyzer—one which will be as far ahead of the present one as that was ahead of anything else. In another year the machine should be completed.

The new machine will be a sight worth seeing. As part of the equipment, a complete automatic dial exchange from the telephone company was brought in. The whole machine will weigh tons, and fill a large room. There will be hundreds of vacuum tubes, new and baffling systems of power communication. Instead of a mere six integrators, there will be nearly twenty, with space for several more to be hooked in. They will be really high speed, running 5000 rpm. or more. Mechanical transmission of the torque is impossible now without slippage. The little disk is extremely light weight, and runs balanced on fine jeweled bearings. The torque will be transmitted by a new tele-torque amplified. A specially designed segment on the axle of the disk cuts an electrostatic field, transmitting by complex circuits and vacuum tube amplification the rotation of the small shaft to a large shaft with regular gear train. Electromagnetic fields had to be avoided because of hysteresis and heating effects.

In the new machine, instead of plotting curves, the actual numerical data can be used, adding an advantage of the punched-card machines. In this case the data will be punched on a continuous tape like a player-piano roll. Since this will be the same type of data that would be used to plot a curve, there will be blank spots between separate entries. A curve could be drawn smoothly between these points. The new machine, though, will automatically compute the intermediate points, making use of fifth differences, providing an accuracy greater than could be obtained manually by drawing the curves.

In addition, instead of having to set the integrators and other parts to fit the initial condition of the problem, all that can be put on a piece of tape, one section of tape for each integrator. The tape will feed through the machine, pausing for about twenty seconds to allow the machinery to start moving to set each integrator. After the tape has fed through, the machine automatically starts the tape through again, just to check that everything is set correctly. If one of the integrators is wrong, the machine checks that again, and if it still is wrong, a bright light flashes on at that one integrator. Dean Bush, in describing the machine, once said that there had been discussion of having the machine call out "Yoo-hoo!" if something went wrong, but the light was thought sufficient.

Despite all this complexity, despite everything the machine can do in solving complex problems, still it is not a thinking machine. Operators are necessary to decide the way in which the problem goes in, and to decide for the machine what it will do. An atomic wave equation may be put into the machine, and the machine set to print solutions for certain numerical values of the constants. But the machine will not pay any attention to whether the results become physically absurd for an atom because of wrong constants. The machine does not think. It merely duplicates mathematical formulas with mechanical precision. Or if it is of the punched-card type, it picks out and uses only those cards which it has been set to use. Even if the displacement of one card should be come advisable as a consequence of results already obtained, the machine goes blindly, unthinkingly, ahead.

THE NEW differential analyzer is in process of construction. Men are working and planning for a new and greater punched-card machine. When these are in operation, tremendous advance is possible; new knowledge in atomic structure, new theories on the origin of cosmic rays, improvement in the methods of radio and television transmission, better power transmission and new design of transformers and vacuum tubes. Even, perhaps, new designs for new types of computing machines based on different principles will come. Scientists look ahead and dream of new calculators. They will not be as compact and as effective as a human brain, or even portable.

The dream machine may fill an entire building. It will be operated from a central control room made up entirely of switchboard panels, operated by trained mathematicians, and an automatic printer giving back the results.

A physicist has spent months getting a problem ready for solution. He has long tables of numbers, experimental data. These numbers have to be combined and recombined with still more numbers, producing hundreds of thousands or millions of numbers—far ahead of the simple moon problem.

His tables are typed by a stenographer on a special machine which punches them on a tape. The constants for his equations are punched on another tape. The tapes and the directions giving the order of the use of the numbers are turned over to the operator. The tapes are fed into a slot, a switch pulled, and in a few minutes every number has been multiplied by all the other necessary numbers. Perhaps they must all be multiplied by a series of Bessel functions. A switch is turned to feed in Bessel functions, and a key punched to allow only one class of these to operate.

A dream machine! Not a thinking machine, but a powerful tool for the scientific brain; to do work that can never be done otherwise without wasting lifetimes on drudgery. A dream, but possible right now with what we know of mechanical principles.

THE MOTH

By ROSS ROCKLYNNE

THE MOTH

An entirely new idea in space-drives, a new principle, is suggested by

Ross Rocklynne

Illustrated by Orban

I FOUND Harry in his office, where he should be generally, but isn't, most of the time. His big feet were propped up on his classy mahogany desk, and his hat was pulled down partly over his eyes. I knew he was thinking about that dirty dog Rimpler, and about Rimpler's unsigned confession in his pocket, and about three of his freighters, which only yesterday had blown up in midspace.

But he saw me as I opened the door.

"Hello, fashion plate," he said heavily. "Or maybe I should say chain mail."

I came across the room, leaned forward on the desk, sore at him as usual.

"This shirt," I insisted, "is the latest in men's wear. And if you'd keep up with the—"

"It clinks," he muttered sleepily.

"Musically," said I, angrily. "And as I was saying, if *you'd* keep up with the times, maybe this forty-million eagle corporation—"

"Fifty million, counting good-will assets."

"Forty million *not* counting good-will assets. Because if you don't have the good, common sense to have a confab with this Granview girl, we won't have the good will of anybody at all. Now for goodness' sakes, get up and listen to me!" And I came around the desk and grabbed his eighty-pound legs and swung them around and then dropped them.

He pushed his hat back, drew himself upright, and regarded me out of the laziest, don't-caringest eyes east or west of the Sacramento—and you've seen him in the papers—Harry Bournjeurs, president and grand stockholder of Bay-Mars, Inc. He looked at me as if I was nothing more than treasurer of Bay-Mars, which I am. He sighed gloomily, fished into his pocket, came out with a salt tablet. He popped it into his mouth, crunched, made a face, swallowed.

He scratched the tip of his nose, looked at me through the mat of hair on his wrist. "Uh, Bill," he mumbled cautiously, "you mean she's back again, with this same crazy idea?"

I pulled back my sleeve—too hastily, for the tiny chains did clink, and not very musically at that—and looked at my watch.

"In fifteen minutes she won't be here any more. In fifteen minutes she's going across the river to Rimpler's outfit. And when she goes across the river to Rimpler's outfit"—I shrugged significantly—"we may as well go halfway across the river."

"Yeah," he said, frowning, and drew his six feet two to its feet. His clothing was not pressed. He locked his hands behind his head, sauntered toward the window, looking down vacantly on Parts Production Section No. 2. There was a lot of sound down there, but none of it got through the windows.

"I don't like this," he muttered. "I don't think this Granview girl has got

everything she says she has. She's trying to pull some kind of fancy bluff."

"I can't understand," I exploded, "why you didn't see her the first time she came. You should have listened to her at least. *I* listened, and, Harry, the thing's beyond belief. It's new. It's colossal. It's an absolutely new mechanical advantage."

He lit his pipe with fumbling fingers, turned around. "All right," he mumbled and started for the door as if he had a bad job to take care of. On the way he smoothed down his black hair and buttoned his wrinkled coat. He looked almost presentable to a pretty girl.

WE WALKED down the hall and Harry was so lost in troubled thought that workers passing didn't get a word from him. But after we got down the stairs, he dawdled along, stopping every half second to question one of his workers about something, and I knew he was just stalling. But finally we got to the girl, in my office. She'd raised the blinds, was looking down on the smelters, through the ice water running down the outside of the panes. When she turned around, Harry jerked and turned pale, and I guessed he was hardly prepared to see a trim, little, blue-eyed girl trying to sell him a billion-dollar scientific discovery.

I introduced them and Harry made a very vague reply, and then sat down uneasily and looked at her. Automatically, he reached into a pocket and extracted a salt tablet. He was about to pop it into his mouth when he remembered himself and closed his fist around it.

We said a few things about the weather, which was hot, and Harry didn't put in any leading questions. He said, "Yeah, it is," or "Uh-huh." He was looking at Miss Anna Granview as if he was fascinated by her.

But suddenly he said, like this: "You're a very charming young woman, Miss Granview."

"Thank you," she said sweetly. Her very curved lips were a little malicious, or was I imagining things? "And I trust that your salt tablets are holding out?"

He seemed shocked by that, and fidgeted and muttered, "Uh, yeah, yeah." Then he shot himself to his feet and stood over her, his lips pursed.

"Just how," he demanded, in an ugly tone, "could a young thing like you fool around with rocketry, and come out with anything worth while?"

"It's not rocketry," said she, crossing trim legs, and taking a cigarette out of her purse. She lit it herself, when Harry didn't take the hint. Her eyes were getting more malicious by the second. She blew out a plume of smoke. "What I've got," she told him, "will make rocketry obsolete. Out it goes, like sailing ships to steamboats! Oh, I didn't work it out alone. I had the help of a—friend."

Harry's lips turned down the slightest bit.

"Spill your story," he said heavily, as if he'd lost interest, which he naturally hadn't.

It is safe to assume that he had a lot of things on his mind then, mostly a savage hatred of Rimpler, who was using all the underhanded tactics he could get away with to drive us out of business. Harry was probably thinking about that unsigned confession of Rimpler's. It was a pretty sizable list, covering the last three years, and at least once a day during that time I'd seen Harry take that paper out of his pocket, and just imagine what he'd do if he had Rimpler's name signed at the bottom. Lord! That'd be the end of Rimpler for a fact! So what if this pretty Granview girl took her stuff across the river to Rimpler? It'd be the last lever

Rimpler'd need to send Bay-Mars crashing down around our ears.

She was talking. She had a sweet voice, but she wasn't taking much trouble to conceal her dislike of Harry. I couldn't figure where she'd acquired that, because there really wasn't much wrong with Harry, except that he was twenty-eight years old, and he'd told me he'd once been badly disappointed in love, and he was getting dated—and when I say dated I mean as an example his refusal to wear chain-mail shirts.

"Sorry," Harry was mumbling at her. "I didn't get that about the mechanical advantage part. As a matter of fact, Miss Granview—or may I call you Anna?—you're so subtly throwing slurs at Bay-Mars, and your voice is so mushy with honey, that I can't get any sense out of what you're saying. Will you repeat, please?"

"Sorry," she said soothingly. "I didn't mean to slur Bay-Mars. It's a grand old company, and even though it doesn't keep up with the times, hasn't got all the modern equipment Rimpler is using, people are going to remember the Bay-Mars' tradition and they're going to keep on using Bay-Mars' ships, naturally."

"Naturally," said Harry. His black eyes were smoking. I supposed he realized the more he said, the harder she'd come back at him. "Go on," said Harry.

SHE put out her cigarette. "Now," said she, "I'm sure the device can be explained fairly simply. It's a field that envelops the whole ship, and it acts in such a manner that electronic orbits in the direction of motion are flattened. That's where the mechanical advantage comes in. What you lose in length you gain in speed. It's really a brilliant principle."

Harry munched on a salt tablet, a bad habit of his in hot weather. "What," said he deliberately, "is a brilliant principle?"

Her eyes snapped. "What you lose in length you gain in speed!" She caught herself and flushed. She made a show of brushing off her dress. Her eyes came almost angrily back to Harry's. "I hate obstinate people," she remarked bitingly. "Do you think we could go through this without bickering, again?"

Harry's lazy eyes came to life for some reason or other, almost turned hard. "If you want to." His voice was almost challenging.

She dropped her eyes momentarily. She raised them. She went on as if nothing had happened. "The Lorentz-Fitzgerald contraction theory, Mr. Bournjeurs, postulates, in trying to explain the negative results of the Michelson-Morley experiment, that an object in motion loses physical length in the direction of motion."

"I thought," said Harry, "that was only relative to the observer."

"That," she told him, "is Einstein's idea. But there is an actual physical contraction. Now I—and my friend, of course—got the idea that that ought to work backward. Carried to its logical conclusion, my point can be made clear by explaining that if you decrease the length of a ship to zero, it automatically assumes the speed of light. So in order to gain any desired speed, *without acceleration*"—she emphasized those words herself—"you shorten the ship commensurate with that speed."

"Uh-huh," said Harry doubtfully, and appeared to be thinking seriously. I thought that by the way his heavy brows were coming down he was getting interested, and he was at that, but damned if he didn't have something else up his sleeve!

He leaned forward, and his eyes were amused in a hard way.

"Let's get this straight. You decrease the length of the ship and she immediately takes on a speed proportional to that length loss?"

She nodded her small blond head patiently.

"In order to achieve this, you flatten out electronic orbits with your . . . uh . . . device?"

"I told you that."

"And I heard you. The electron orbits are shortened, or flattened in the direction in which the ship moves, thus providing direction choice?"

"Yes."

"So the energy lost by the electrons approaching the nucleus is the energy which directly propels the ship?"

"Yes."

"Or you might say that's simply the behaviorism of matter when electronic orbits are flattened in the direction of motion?"

"Yes."

"There is no acceleration, because the field acts equally on all the electrons in the ship."

"Yes."

"Felix Rimpler is your 'friend'."

"Why . . . ye . . . no!"

"I thought so!" Harry barked, jumping to his feet, his eyes blazing.

SHE CAUGHT her breath. She slapped a hand over her mouth. Her face became furious. "I might have expected that from Harry Bournjeurs," she exclaimed. She grabbed her purse and started toward the door. My heart bounced up and back with a two and three gravity acceleration each way, respectively. I was frozen stiff at the way that reversed contraction device—I mean the girl—was heading for the door. It—she—was almost out when Harry grabbed it by the arms from behind, slammed the door shut, and plumped it down in a chair. And there it was, struggling to get up, its very lovely eyes furious, its skin a dead-white, its mouth open for a scream.

"Scream," invited Harry. "But the office is sound proof. Now let's get a few facts straight, here. I've got Rimpler's unsigned confession in my pocket, and it lists a lot of filthy tricks he's pulled on me in years past. This is just another, isn't it? Where's the catch in this little tale of yours, and what does Rimpler expect to get out of it?"

"He doesn't expect to get anything out of it," she hissed. "Because there isn't any catch in it, and in the first place, Felix"—I saw the maliciousness in her eyes again—"didn't send me over here! Now let me go!"

She kicked Harry's shins.

Harry didn't let go, but I could see the beginnings of anger fuming out of his slow brain.

"Rimpler," he went on grimly, "is the real inventor—or else one of his thousand-dollar-an-hour stooges. And I wonder—" Abruptly he let her go, and started walking around the office.

Watching the girl, I was surprised to see that all the murderous anger had left her face, and she looked half tearful. I couldn't figure it out. How had Harry guessed that Felix Rimpler was Anna Granview's friend? Why had Harry and the girl flown at each other's throats the minute they'd seen each other? If Rimpler had sent the girl across the river to sell this secret to Harry—why? And if the girl hadn't been sent over by Rimpler—

She came up behind Harry, where he was standing looking down on the smelters. The odd way his tough-looking shoulders were hunched, and his hands rammed down in his pockets, I knew he was sore about something. What it was I didn't know, because you don't get sore at a man like Rimpler; you just get even with him.

She hesitated a minute behind him and then said in a very small tone, "I'll give you a satisfactory demonstration tomorrow. From your own field. At four o'clock. But I'll be here early in the morning. I'll need some of your men. And I'll have to convert one of your test ships."

"All right," Harry said, without turning his head.

She turned on her heel, grabbed up her purse hurriedly, went out the door. I heard her heels clicking up the hall toward the elevator.

Harry turned around, his eyes strange. "It's unbelievable," he muttered. "It's incredible. But I can't take the chance!"

"What d'you mean, you can't take the chance?" I asked him, staring. "Damnit, Harry, this is the making of Bay-Mars! It that invention works, it means the complete and final end of Rimpler's competition!"

He continued to look at me strangely.

"Oh," he mumbled. "I wasn't thinking of that. Not of the invention."

He frowned and made for the door. I followed wearily after him. Something was all mixed, but what it was I guessed I'd never find out.

When we got back to his office he walked around in befuddled circles for a while. Then he sat down. I got tired of watching him, so I got up and said I'd be seeing him. As I started to close the door, I heard him lift the receiver off the telephone and dial a number. But not being much of an eavesdropper, I closed the door so I didn't know who he called or what he said.

"SO I didn't get any sleep last night," said Harry in an ugly tone. "So what of it? I was just thinking that maybe I did the wrong thing. I was thinking about it all night. Now shut up."

We trudged across Harry's big, dusty field toward the ship, with the three workmen working around the stern jets. Harry's face was drawn and a little bit sickly. The nearer we got to the ship, the more nervous he seemed to get and consequently the more nervous I got, because I saw there were things going on beneath the surface that I wasn't being let in on.

We got to the ship and Harry said a few vague things to the workmen fooling around the ship, and then the girl came around the stern and smiled at us very politely.

"Afternoon, Mr. King. Afternoon, Mr. Bournjeurs," said she, and then asked us to come inside the ship. We followed her up the steel ladder, Harry stumbling a little. He looked as if he was in a daze. He couldn't take his eyes off her, and I had to give Anna Granview credit.

She was up to the minute, and she had the figure to make all the modern stuff stand out! She had this golden yellow hair, of course, and this metal band around it with the fore-and-aft bells on it made her sound out, too, and sometimes she was being so terribly sweet to Mr. Harry Bournjeurs you couldn't tell her voice and the bells apart. Every time she turned around to trace the cables strung from stem to stern of the ship, her sawtooth cape made a red-silk sound, or is there a sound like that? Anyway, she was a creation of her own mostly, and of–God partly, and Mr. Harry Bournjeurs was dazzled and dopey as she went on talking about her outfit.

That ship! They'd practically taken her internals out making room for the gadgets. The stern control room was no more, and gone were all the shiny dials and U-bars, and studpockets and plungers. Standing there instead was this big ugly makeshift cabinet buzzing away and making all the multitude of tiny helices along the bulkheads, and the big ones standing smugly down the central companionway, sputter in the pink.

I could see, after a while, that Harry was waking up. His trained eyes followed the cables, and figured out reasons for this and reasons for that, and finally he pulled a panel off the cabinet and looked inside. His trained eyes followed the leads down and around, and he must have got the idea of the business in his head by the time Anna Granview saw him, and came up be-

hind him, smoke in her eyes. She slapped him on the hand, hard.

"Mustn't touch," she snapped, and put the panel back on, ignoring the smoldering look in Harry's eyes.

"Funny," Harry mumbled. "Didn't know I had a reputation for stealing unpatented inventions."

"Didn't know I had a reputation for double-crossing people," she said, and added, "Let's go outside," and she went out the airlock and started down the ladder. We followed, and Lord! Harry's face, for some reason, was getting sicklier by the second.

Anna Granview pranced down the ladder and set foot to the ground. She started toward the ship's stern, and then she froze, staring off across the dusty field toward the road that led in from Rimplerville across the river. A big black streamliner was turning from it into the drive. As we watched, the bullet whizzed off the drive and came straight across the field, shaking up a lot of dust, and sinking to an air-brake stop a half dozen yards distant.

In the driver's seat? Well—Rimpler!

LORD! For some reason I felt the blood freezing in my veins. My breath stopped. I had a sensation of impending catastrophe and I was sweating on the forehead. If you've ever seen Rimpler, you'll know what I mean. When he's got something on his mind that means trouble for somebody else, it shows in the silkiness of his walk, the sharpness of his eyes, the cynical, sadistic leer of his lips, and the angle of his otherwise cowardly chin.

Off he came across the field toward us, and I saw Harry's face get absolutely ghastly, and I saw Anna Granview get a wild look in her eyes.

Rimpler's eyes swept us all. They swept the ship, landed on the gadget the workmen had just finished welding on the ship's tail, and then came back to us. He put his hands on his slightly oversize hips and regarded us all with malicious contempt.

"Good enough, Anna," he said sardonically. His voice went all the way down to thirty cycles—five more he'd have been thunder. "You've got an angelic face, and your pure soul bobs up into your eyes whenever you want it to! Fine! You've fooled me, but you're going to pay for it. And you, too, Mr. Harry Salt Tablet Bournjeurs," he sneered. "Deliberate theft of an original invention will give you a juicy term in a Federal prison. And as for Miss Anna Two-Timing Granview, I'll see personally that she rots—"

"Wait a minute," snapped Harry, his face coming out of its trance and getting murderous. He jumped down from the ladder, and grabbed Rimpler by the coat front. He said, "*Now* finish."

Rimpler looked down at Harry's rather massive circling fist.

"Slight correction then," he said coolly. "For the perfectly obvious theft of a new interplanetary flight principle both you and Anna Granview will be prosecuted to the fullest extent of the law," and he broke away from Harry's loosened grip.

Harry said slowly, "I . . . uh . . . don't get this exactly." He turned toward Anna.

"You . . . you heard what he said," whispered Anna. "It means just what he says it does."

Rimpler broke in with a short, harsh laugh. "And don't think," he told Harry, "that when I get through with you that Bay-Mars won't be just a pleasant memory!" and he turned on his graceful legs and went toward his car.

"Wait a minute," Harry rapped out and he moved, well—fast! He caught up with Rimpler, whirled him around, made a fist, and brought it up from the hip, and bang! Rimpler went down. A little cloud of dust rose around him.

The shadowy giant, irresistibly drawn by the radiation, circled angrily about the little group.

Harry stood over him and then reached into his pocket and took out a salt tablet. He looked pensively at Rimpler. He began chewing on his salt tablets like they were peanuts. Lord! I don't know how the hot weather perspires as much salt out of his body as he puts back in when he's excited. But he gestured to the three workmen watching the scene, and when they came up, he said:

"Finished that job?"

"All except one lead," said one of the men.

"You go fix it. You other two take this man"—he indicated Rimpler—"inside. Aft cabin. And . . . uh . . . can you keep your traps shut about this? Not a word?"

They grinned. They didn't like Rimpler and they did Harry. So they nodded and went about their jobs. Harry took Anna's arm and forced her into the ship. I followed, scared to death at the complications.

HARRY worked the airlock valves, and they ground to. Then, except for that one lead, we were ready to start, if the contraption worked. Anna sat down, hands in her lap, pale and shaken. Harry leaned against a stanchion, looking out the rear port at the workmen.

I came up behind him. "All right," I hissed. "Fine! First, we're implicated in deliberate theft. Now it's kidnaping. Now murder becomes the logical thing, doesn't it?"

Harry's shoulders lifted in a slow shrug. He didn't answer. Suddenly the workman outside waved his hand and grinned and jumped off the ship. Harry went forward, weaving around the glowing helices stuck in mid-aisle, and Anna Granview looked at him apathetically. She looked as if she'd lost all hope. Harry didn't pay any attention to her. He bent over the contraption, frowning. He grabbed the two handles sticking out of the machine close down at the bottom, and he squeezed them, hardly a millimeter.

Something happened. Damned suddenly! The familiar sensation of being on Earth was gone, like that! I jolted forward and pressed my face to a port. There was the big pock-marked Moon getting bigger by the second, bigger, bigger, and then *whoosh!* Back into the distance she went. There was nothing but stars, a couple of planets and a beautiful comet smearing itself across the sky.

"Hm-m-m," said Harry in a tone of surprise. "It works. The customers will like this—no acceleration."

"They won't like it now," said Anna Granview dully. "Not your customers, anyway." An angry look came to her face. She snapped herself to her feet. "I was a fool," she said, glaring at Harry, "for getting mixed up in this! And all for somebody that hasn't got the sense—"

"What," said Harry, cocking an eye at her, "are you talking about?"

"I think you're very dumb," she bit out slowly. "Dumb!" She swished around.

Harry said to her back, "Oh, I don't know," and he turned back to the contraption and took out a panel, and spent about fifteen minutes muttering: "Uh, now, le's see. . . . Yeah, uh-hm."

Suddenly Rimpler groaned. Harry looked thoughtful and worried and then threaded his way aft. I looked apprehensively at the string of helices—they were way up in the intense violet—but nothing looked as if it was going to explode, not yet anyway, so I took Anna's arm and we went back to Rimpler's cabin.

AS WE looked down on his slightly overfed figure, he squirmed and groaned again, his eyes opened and then got wild.

"You!" he muttered thickly, staring at Harry. "You . . . you hit me!" and

he started to get up, but Harry pushed him back with his left hand and waved his right fist suggestively.

"Uh—stay where you are for a while, Rimpler," he muttered. "Got some things we want to talk over."

"You kidnaped me," Rimpler hissed. "You other two are accomplices. I'll make it a special point to get all three of you death penalties!"

"Uh—shut up," said Harry thoughtfully. He went on, "Anna. You deliberately stole Rimpler's invention?"

"It wasn't his," she muttered. "One of his professors worked it out for him. Rimpler told me about it, and I got hold of duplicate blueprints and had the parts made."

Rimpler's face was furious. "You played me for a fool. You made me think you were interested in me. You let me make love to you. You . . . you traitor!"

"You can stand a little betrayal!" She grabbed Harry's arm. "Listen, Harry, I'm not ashamed of what I did . . . in fact, I'm glad of it. I stole this invention for the benefit of . . . of Bay-Mars, and it doesn't hurt my conscience, because Rimpler would have done the same thing to you, and in fact he has done the same thing to you. So you've got a complete right to steal this principle if you can get away with it. In fact, you'd better, or it'll be the end of Bay-Mars!"

Harry was looking at her as if he was fascinated. He looked as if he couldn't believe his ears. "So that's it. You did it for *me*."

"I said Bay-Mars." But by the way she looked I knew she'd done it for *him*, and then I began to see what this was all about. It was shocking. It sounded fantastic. But damned if it wasn't true! I remembered Harry's telling me about this girl that had jilted him some years ago. She'd had nice blue eyes, yellow hair, a fast tongue and they'd had a spat. So— But you get it, and anyway, that discovery was bitten right in two by another, and I felt sick when I said weakly:

"Harry, it was *you* who called Rimpler and told him about the new type ship they were trying out at the Bay-Mars field!"

He looked disturbed. "Yeah," he said, frowning.

Anna Granview clamped her lips. "So," said she, "you thought I was double-crossing you, and you wanted to show Rimpler *he* couldn't pull the wool over *your* all-wise *eyes!*" She sneered.

Harry shifted uncomfortably.

Rimpler laughed a short explosive sound, and disregarding Harry's fist, swung himself to a sitting position. He chuckled mirthfully at Harry, his perfect white teeth showing in a grin.

"Fine! Fine! So Harry Bournjeurs, salt tablets and all, pulls the noose over his own head. I'd like to bring that point up in court, damned if I wouldn't!"

Harry rubbed at his clean-shaven chin. "Uh," he said, "I don't think you're going to bring *any* points up in court."

"What?" snarled Rimpler.

"I've decided to drop all charges against you if you drop all charges against me!"

"What?" Rimpler stared at him. "You're nuts, absolutely, completely batty! You haven't got any charges to make against me!"

"I will," Harry promised imperturbably, "when I have your confession."

Rimpler dropped back dizzily onto the bed.

"Confession? Confession? I didn't make any confession!"

"You will," Harry predicted. He reached into a coat pocket, took from it a much opened and folded piece of white paper. "For instance," said Harry, opening it, but not even reading from it,

since he knew it by heart. "In 2118, when you opened up competition against me, some guy planted a bomb in my foundry. Up went the foundry and a couple of night watchmen. Latter part of '19, the bridge from Rimplerville to my side of the Sacramento was blown up at the precise instant a string of freighters bearing iron ore to my factories had almost got across. In '20, once for each month, little acts of sabotage. In '21, day before yesterday, in fact, three of my new freighters went bang in midspace. Those are the bigger things; I'm not mentioning the smaller. Come to think of it, after you sign this, I might prosecute *you*. I guess your accusation wouldn't have much weight after that."

Rimpler expelled a long breath.

"I deny having anything to do with the atrocities you mention." He talked as if he realized that anything he said would be used against him. He raised himself to his elbows, his eyes gleaming. "Better not waste your time, Bournjeurs," he snapped. "You know I'd never be fool enough to put my name to a paper like that."

Harry frowned. He sighed. "I guess," said he, turning, "we may as well go back to Earth."

Rimpler levered himself to his feet. His face got smug.

"Now," he declared, "you're showing sense. And come to think of it, Bournjeurs, maybe I won't be so hard on you as I promised. Maybe I'll let you off easy."

"Oh," said Harry. "You're relieved I didn't follow through. Good, final proof," and for the second time that day, he moved twice as fast as he usually does. Around he swung, and his fist swung with him and banged against Rimpler's receding chin. Rimpler tottered and fell and stayed on the floor, squirming.

Harry looked at him. "Now," said he, "this gives us a chance to get a good solid patent on a new interplanetary flight principle, and . . . uh . . . to get Rimpler's signature, and to . . . uh . . . have some fun." He made his way out of the cabin and Anna followed him.

I supposed it was my duty to stay there and watch Rimpler. For a few minutes I looked at him uneasily. What if he got up and hit me over the head, little as I am and big as he is? It was very disturbing and I was about to take a sheet off the bed and tie him up in self-defense, when I noticed something strange out of the corner of my eye.

MOON and Earth. More particularly the Moon, because the Moon, with the exception of the larger areas which are the seas and the craters, is almost entirely white. Now, suddenly, the whole white face of the Moon clouded up, to a sort of blue-green, then, as fast as you can think it, to green, to yellow, to deep orange, to red, to deep black-red, and then—black, with a faraway suggestion of red! And there it stayed, while I stared, fright clotting my blood. And the Earth! It was worse. From space, it's normally an azure planet, but all that was gone. The damned seas had turned inky black and all the land had turned snow-white—and I turned apple-green!

Now you'll remember we were still zipping along through space under the reversed contraction device, and our whole speed was caused by the behaviorism of matter compressed along the length of the ship? Well, I remembered that suddenly. I remembered the Fitzgerald contraction. I thought a thousand fantastic things. I thought that maybe Harry had worked the ship up to light speed! I thought that by some freak of the law, a hundred million years had passed in the outside universe, and the Earth and Moon had burned slowly down to charcoal.

But the stars were absolutely the

same. So that wasn't the reason. I stood there gaping, I don't know how long, and I must have been utterly dazed, because I didn't hear Rimpler move, and I didn't hear the airlock valve grinding open, and I didn't hear the valve of the lifeboat open. I didn't know Rimpler was gone, until in came Harry, and tapped me on the shoulder.

I jumped a mile as I turned, I was so scared. I couldn't say a word, as I looked at Harry.

There was a smug look on his lazy face.

"Rimpler," said he, "is gone. Didn't you notice?"

I looked where Rimpler used to be. "Gone!" I gasped. I couldn't say any more. There was a pressure almost of horror behind my eyes. Looking out into the central companionway, I could see through the little window into the airlock—and the single small lifeboat wasn't there any more. So this was the end. Rimpler'd go back to Earth. He'd go back and swear out warrants for us. Theft of an original invention, assault, kidnaping!

Harry popped a salt tablet into his mouth, crunched on it, made a face. "Uh," he said thoughtfully, "what do you think of the mother planet? Strange-looking thing?"

I mumbled something, and finally got my wits together. I stared at Harry in growing suspicion. He didn't seem to be taking this so hard at all!

But he grabbed my arm, and turned me around toward the port again.

"Interesting phenomena," said he, and I knew then he was baiting me, and had something up his sleeve.

"You wanted Rimpler to escape!"

"Yeah," he said, frowning. "But let that go for a minute. Interesting phenomena, this—seeing in the infra-red. That Moon— Well, the larger the rods and cones in the eye get, the more, more and more the upper wave lengths are cut out, and the more the wave band beneath the dark-red shows up. The violet would go first, then the indigo, the blue, and all the way down through *vibgyor*. Until the whole visible spectrum would be gone, until finally, when you were, say, a hundred times as big as normal, you'd be seeing in the infra-red down to about a hundred microns. So the Moon, being a poor reflector of infra-red—heat waves, of course—would show up pretty black. Earth's oceans the same. High absorbers of infra-red. The land reflects heat pretty well, so it's white."

"Harry," I said finally, in a deadly tone, "what did you do?"

He shifted uncomfortably. "Well," he muttered, "I just shifted some wires around."

"What did that do?"

"Well, instead of flattening one side of an electron orbit, it flattened all four sides—compressed it."

"Then?"

"I changed some more wires."

"And?"

"The orbits expanded."

"And?"

"We are," said Harry, suddenly grinning, "about a hundred times our normal size. Just a cloud of matter hanging out in space."

That froze me. I was almost afraid to move. I looked down at myself, but I looked just the same as ever.

Harry sat down, grinning at me. "Every atom is snugly in place," said he. "That is, relatively. But of course the Earth is going to be, comparatively, about a hundred times smaller. Now look here." He leaned forward and his face was serious. "Rimpler's going to get back to Earth, but when he gets back he's going to find out that, being a hundred times bigger, his ears won't accept anything but infra-sound and his voice won't make anything but infra-

sound, and he's so nebulous that he won't reflect hardly anything but infra-red. So how's he going to tell the world about our sins against him?"

"But I don't get the idea. Damnit, Harry, you can't leave a man blown up like that, even Rimpler. Maybe for a while, but not forever. Maybe just long enough to get—"

"A patent," said Harry smugly. "And also," said he, "maybe Rimpler would—uh—pay a price to get 'down'?"

He took Rimpler's unsigned confession out of his pocket and waved it gently in the air. And I got it. Rimpler's name on that damned document meant everything. It meant he'd have to keep his mouth shut about *everything,* patent stealing, double-crossing, assault, kidnaping! It meant that he'd get paid back for his misdeeds in his own coin.

So we went out to the controls, and Harry did his mumbo-jumbo over the device, and the Moon went back to normal, and Earth got its true color back. And all the while, Anna Granview had a smoldering look in her eyes, and she wouldn't talk to Harry for hell or high water! So I guessed it was all off again between her and Harry.

So Harry pressed two little handles together about a millimeter and all the little electron orbits sagged back in a different direction, and off we went for Earth, I wondering and worrying about what Harry had up his sleeve, and feeling, I must confess, very sorry for Rimpler!

SOMETIMES in the two days that followed, I was certain I saw it. Rimpler's ship, I mean. It was on the Bay-Mars field. It was a ghost! I'd stand on the edge of the dusty field, and look and strain my eyes, and all of a sudden, as if a blind spot in my eye had been removed, I'd see that "little" lifeboat. But it was like a shadow on air; it was a blot of shade without definition. I couldn't see the controls or anything inside. Sometimes I wasn't even sure it was there, because people moved right through and since they weren't looking for it, they didn't see it.

As for Rimpler, neither Harry nor myself saw him. Harry was worried a little. He told me he thought Rimpler'd stay around the Bay-Mars field, practically begging for contraction. But now we were both getting a sneaking suspicion that Rimpler knew what was in the wind, and he knew what Harry'd done to the ship, and just for pure meanness, he was making *us* worry about *him!*

And we worried, too.

"He might," said Harry uneasily, "have gone crazy. I don't want to do *that* to a man. I guess it's enough that we rooked him out of the invention. Uh—now, let's see. Maybe . . . maybe air reflects infra-red at a hundred microns. Maybe the whole damned atmosphere is

opague. Maybe he's wandering around the world, lost and going crazy."

Pleasant things he could think of. But I didn't say anything, because I could see he was thinking. His face got a very studious look. He walked back and forth in the office, and all of a sudden, *bang!* he got it.

Out he went from the office, leaving me gaping and without an invitation to go with him. But ten seconds later, I looked through the office window down at Parts Production Plant No. 2, and I saw him talking with a couple of his workers. They listened and they frowned. They scratched their heads, and they looked at him close to see if he was crazy. But he wasn't, so they turned away, and put aside the work they were doing, and started on something else.

Harry came back to the office.

His face was flushed. "Uh, Bill," he mumbled, munching on his salt tablets as if it was an extra-hot day, "what happens to light when it passes a dense body, such as the Sun?"

Patiently, I said what he wanted me to say.

"Then . . . uh . . . if the Sun bends a light ray, the light ray must also bend the path of the Sun—huh?"

He hadn't been taking dope. His eyes were absolutely normal.

He didn't wait for an answer. He said: "It has to. For every action a reaction. Newton's Third Law of Motion. Light has mass. The Sun has mass. So they bend each other proportionately. Now what is photo-tropism?"

"Moths have it," I said, feeling sorrier for him every second.

"Moths around a candle flame. They go round and round. They call it photo-tropism, but they don't know what it is. But *I* know what it is."

"You do?" I said cautiously.

"They keep falling toward a bright light. They think they're going in a straight line. But they find they have to go at a certain speed to keep away from the light. When they don't go at a certain speed, their paths are warped into the light. It's the behaviorism of the matter the moth is made of. That's photo-tropism, of course.

"Now," said he, munching furiously away at his damned tablets, "we'll get hold of Rimpler, and he'll come a-running, because *he won't be able to stay away!*"

AND he didn't stay away! I stood there in the middle of the field. Harry was standing next to me, and that reconverted Coolidge tube was sputtering away and knocking out its practically incandescent infra-red rays. Harry and I kept turning around and around on our feet, watching Rimpler, until we were feeling as dizzy as he must have been.

Out of the murky distance he'd come rushing, galloping like Goliath. It was the infra-red flame that drew his mothy, nebulous frame. It was the warping of light on frothy matter. It was photo-tropism, and Felix Rimpler, the dog who'd done us wrong at least once each month for the past three years, didn't have a thing to do with it. He was living in a strange, unnatural world of his own, where the atmosphere was translucent only, where the seas were ink, and the shores were snow, and there weren't any bright lights at all. Then *bang!* in the distance he'd seen this bright flame, and he couldn't take his eyes away. He started moving, and he had to run to keep up with himself.

He was nothing but a big moth.

He was afraid of burning himself on the flame. And so he went around and around and around.

For about twenty minutes. Then Harry, looking very satisfied with himself at Rimpler's unhappy state, asked the technician if he had the mike hooked up. The technician said he had.

Harry threw me a look that said, "Watch this," and he grabbed the mike.

"Rimpler," he snapped in an ordinary speaking voice. The tortured circling giant heard him. His massive, hardly visible head jerked, and he turned almost transparent eyes down on us. He must have made some kind of croaking sound to judge by the look on his face, but of course we couldn't hear it, although he *had* heard us. Harry had simply stepped his own voice frequency down to Rimpler's—he used an audio-frequency transformer, and transmitted the result in sound.

Harry went on talking. "Now," said he into the mike, "raise your right arm, will you, Rimpler?"

Rimpler probably thought that had something to do with his immediate salvation, so up went his arm.

"That," said Harry smugly, "means we'll shut off the flame, and come up and get you and bring you down to normal—*if* you sign your confession."

Rimpler's arm stayed up a second more, swished down, and then after another second, went helplessly up.

Harry signaled the men standing near the big Coolidge tube. One of the men nodded and pulled a switch.

I looked at Rimpler's fantastic, barely visible image hard, feeling like a fool for believing in all this. Rimpler a moth? I could believe he was a snake, and he was, but a moth? What does a moth do when the candle goes out? I suppose it flutters around, but Rimpler did not flutter. The second he was in control of himself again, he kept on going, at a tangent to his dizzy circle. A wavy, staggering tangent, but directly *away*.

He was lost in the distance, running for dear life to get away from the flame, and Harry looked after him, his jaw hardening. He snapped to the man at the Coolidge tube assembly:

"On!"

Rimpler came back again, staggering, every line of his haggard face protesting. He became a moth again, and this time it went on for a full thirty minutes.

Harry muttered to himself, "He'll come across and mean it, this time, damn 'im." Then his face got a gloomy look.

"No, I haven't seen Anna," I told him in answer to his question. "But," said I, "she loves you, all right."

"No, she doesn't," Harry muttered. "I thought she was a double-crosser, and she didn't like it." Suddenly he started. "What's that?" he said hoarsely.

"It looks," said I, "like Anna."

Harry stared at her wordlessly. When she came up she frowned at him and then looked away. The three of us watched Rimpler.

Harry said half-heartedly into the mike: "Rimpler, for God's sake, all you have to do is raise your right arm, and that's all there is to it. I've got such a tender heart that, even if you stole Anna, I couldn't prosecute you for anything."

He threw Anna an annoyed, angry look. But she didn't return it. Instead she smiled, and shook her head, and the fore-and-aft bells rang very, very sweetly, just the way her voice would have sounded if she'd said anything. Harry's eyes snapped open, and he blinked at her.

He was about to say something, when I called his attention to Rimpler. Rimpler's right arm was high up in the air, as if he was in a classroom, begging the attention of teacher.

Harry grabbed the microphone. "And I. . . . uh . . . hope you mean it," he grunted. "Hold everything. We'll be right . . . uh . . . *up*."

The flames died. The three of us watched a very exhausted moth flutter to a stop, and drop to a sitting position in the middle of the Bay-Mars field. I guess we had a right to grin at each other, even as foolishly as we did.

BRASS TACKS

AND SCIENCE DISCUSSIONS

Credit line: Here! Schneeman: Coming up!

Dear Mr. Campbell:

The biggest news of the month is De Camp's article. It gives promise of being the best ever to appear in Astounding. I particularly like his depiction of the giant ameba spread all over the place like a half-cooked flapjack. Ah, me, there goes another favorite plot; what will the authors do without their pet masses of protoplasm menacing the community or the nation?

The best stories were "Employment" and "Special Flight," with perhaps a slight edge on the former, mainly because the latter wasn't so much a story as a description; it seemed to be an incident rather than a yarn.

"Melody And Moons" I thought a bit superfinous. Oh, it was good enough, I suppose, but the same story, with variations, can be found in any one of the better adventure magazines; and I buy Astounding for its uniqueness—there'd be no point in getting it if many of its stories didn't differ from the breezy, entertaining, light yarns that are thickly sprinkled through the pages of the aforementioned adventure magazines.

The same statement goes for the cover; it might have appeared on any one of several adventure, mystery, detective, or what have you, magazines, except for its technique and execution, which, I'll admit, was superior. Give us covers that have something of science-fiction about them, please; and don't make human figures the center of interest in all of them. However, the policy pursued in the past with respect to the covers has been satisfactory, on the whole.

While I'm on the subject of art work, I'd like to ask you to give Wesso a little prod for me. He's capable of much better work than he's been doing for Astounding lately. See if you can get him to revert to the style in which he illustrated "Invaders from the Infinite," or the August, 1936, Astounding—especially "The Incredible Invasion." Also, go easy on these oversimplified book-jacket illustrations. We can read the comic strips in the daily paper, you know. I suppose they're intended to convey the idea and atmosphere of the story—that's O. K., but they might do it a little less crudely.

Miller's "Coils of Time" might be criticized on the grounds that there was a bit too much apparatus used that seemed to demand an explanation, but received none; wherefore the reader cocked a skeptical eye at it and said, "Oh, yeah?" One can't swallow a lot of talk about spatial and temporary warps, invisibility cloaks, blue-hooded automatons, et cetera, without a bit of justification being given one for their existence. But the story was well written and entertaining, although a bit inferior to "Sands Of Time."

Now for something important; I should have put this at the beginning, or in a postscript, maybe: When you get "Gray Lensman" and print it, please don't abridge or cut it in any way; I don't care how many issues it takes up. "Galactic Patrol" suffered so evidently from such treatment that I got quite peeved. I still feel that I need a parachute to get down after being left up in the air at the finish of that yarn, whenever I reread it.

Now, a last remark about the art. The reason I harp so much about it is that it's more susceptible to improvement than the stories. Please let us know, in some definite manner, who does each illustration; if we're going to make remarks about the illustrations, we want to know who we're praising—or knocking; and I fancy you do, too. Also, don't drop Brown entirely from the covers. And more Schneeman.—Ralph C. Hamilton, 846 College, Wooster, Ohio.

February 1938, containing end of "Galactic Patrol," is sold out.

Dear Mr. Campbell:

Best in the May issue are as follows: "Special Flight," "One Against The Legion," "The Day Is Done," "Employment," and "Design For Life." As far as I can figure out there is no reason for "Melody And Moons" and "Coils Of Time." The first is just trash and doesn't do justice to either Private Kelton or Kent Casey. "Coils Of Time" was a mess and had no business in as fine a magazine as Astounding. As a sequel it may be O. K., but to someone who never read "Sands Of Time" it is trash.

But this letter won't be all knocks. Allow me to pause here to sing the praises of "Special Flight." Not for years have I read a more powerfully realistic story than that. As I read farther into "One Against The Legion" I like it better and better.

I'm still waiting for an artist credit line.

Gladney isn't bad as a cover artist, even though, strictly speaking, it isn't science-fiction. Here I have a suggestion concerning the book jackets. Why not use the book-jacket-type illustration exclusively for the serials and maybe

the second novelette, and leave the other types of illustrations for the short stories. Hint's just a suggestion, but I'm getting kind of tired of the eternal book-jacket illustration, especially because most of them just aren't good pictures. Don't lose Binder and Schneeman yet, keep a good grip on them till the time comes when they aren't two of your best illustrators.

How about another good long novelette like "Cloak Of Aesir"? We're all waiting impatiently for "The Gray Lensman," or whatever Dr. Smith is calling his new epic. He is about the only one who really gives us something to bite on. By the way, can the issues in which "Galactic Patrol" appeared still be gotten from Street & Smith?—Charles W. Jarvis, 2097 Iglehart Avenue, St. Paul, Minn.

Conspiracy!

Dear Mr. Campbell:

It's unfair! It's terribly unfair! It must be a conspiracy!

Do you mean to say you have received no letters upholding my courageous stand against slop? If not, why not? Are all the males married and afraid to breathe a word lest the little wife lift the rolling pin? Bah! A fine state of affairs! They're henpecked! All of them!

To take up the Rogers combination first: To wit, James Michael and Mary Evelyn, I state emphatically that this business of two against one is unsportsmanlike. However, right is on my side, and right always triumphs.

Who says that only men are responsible for war and repression? Yes, I mean you, James Michael. How about Catherine II of Russia? How about Catherine de Medici of France? How about Semiramis of Assyria? How about Queen Elizabeth of England? A sweet lot—*not*. The very Joan of Arc you mention, while an inspired national heroine, was chiefly remarkable in the fact that she led men to slaughter and be slaughtered.

On the other hand, the great philosophers and the great religious leaders of the world—the ones who taught truth and virtue, kindness and justice—were all, *all* men.

Mary Evelyn talks of a "few blunders" and "practice makes perfect." There have been too many blunders, and the most consistent offenders are those who have had the most practice and who, indeed, make literary (?) capital out of descriptions of lovely damsels and melting slop scenes under the impression that that is what the readers want. I refrain from mentioning names, but no doubt certain ones spring to the mind.

Here I must admit that as the months pass by Astounding offends less and less, though there have been several lapses. The editor, I must say, does not seem to be very fond of slop himself, judging from the stories he's written—except "Escape"—and the magazine he's edited.

Charles W. Jarvis says I am *creating* an issue. That is wrong. The issue exists and is vital. You have but to cast a look toward the outer darknesses and see certain magazines which make their living out of purveying slop. This system has invaded stf. itself before this, and symptoms of such an invasion are appearing again. Not serious as yet, but to the keen eye none the less alarming. I have the best interests of stf. at heart—believe me—and I assure you that slop is put out merely to cater to a lower class of readers. There is an attempt to increase circulation by attracting certain groups. Very well! They want to make money, so they can have those groups, but they lose other groups far superior in intelligence, in emotional maturity, and sensibility.

Let me state my position clearly. I want no more love interest for the sake of love interest alone. I want love interest written capably, written cleanly, written logically, written inoffensively. I want it written by those who *can* write it. Lastly, since my critics make long speeches about realism, let's have realistic love interest and not slop.

Is there anyone who disagrees with the last paragraph? If so, let him speak now or forever hold his peace, and let this be the last word!—Isaac Asimov, 174 Windsor Place, Brooklyn, N. Y.

Finlay does next month's cover!

Dear Mr. Campbell:

Comes the every-so-often report. Astounding Science-Fiction continues on its super-excellent way—well, I've got to take that back, as the May issue drops to 80.9, which, while good, is below par for Astounding Science-Fiction. The main reason for this subnormal showing is the illustrations, which averaged only 76.8, which is decidedly mediocre after the good pictures you once showed us. As a remedy I suggest removal of Irritant Gladney from the cover, to be replaced by soothing-salve Brown, Wesso, or Rogers. Rogers' cover was one of the best I've seen on *any* magazine at *any* time. For the internal illustrating ailment, which is more acute, I prescribe a liberal dose of Schneeman, mixed well with Wesso, Orban and Cartier. A good-sized capsule of the one and only Finlay would hasten, beyond a doubt, the quick recovery of the patient.

For the Analytical Laboratory:

1.	"The Day Is Done"	90
2.	"Employment"	90
3.	"Design For Life"	90
4.	"Melody and Moons"	85
5.	"Special Flight"	80
6.	"Coils Of Time"	75

The first three are really tied, but if they must be rated, they shade each other the way I have them. "One Against The Legion," of course, must wait until I have the final instalment. The book reviews are entirely acceptable and interesting. The second part of "Design For Life" gives promise of being even more interesting than the first part—Arthur L. Widner, Jr., Box 122, Bryantville, Mass.

Interesting, anyway, though I'm not so sure your premise is acceptable.

Dear Mr. Campbell:

Following is a tabulation I had a lot of fun making, because it proves what I have always maintained; that Charles Schneeman is your only artist, with the possible exception of Rogers, and that the others, with an exception again—Orban—are not only mere illustrators, but for the most part lousy illustrators as well.

This tabulation is based on the obvious fact that the way a story is illustrated has something—perhaps a great deal—to do with the success of the story. Therefore a good illustrator will have a higher percentage of stories rated high in the Analytical Laboratory than a poor one. Right? Very well, then—

Rating the illustrations according to the Laboratory's 1, 2, 3, 4 and 5, and calling the illustrations for a story not rated at all 6—a conservative estimate—I find that your illustrators average as follows:

Schneeman,	with	21	drawings	2.54
Thompson,	"	7	"	3.14
Orban,	"	7	"	3.57
Brown,	"	7	"	3.71
Dold,	"	15	"	4.26
Wesso,	"	26	"	4.69
Binder,	"	13	"	5.13

Of course, since the Analytical Laboratory has been in existence only a comparatively short time, these figures are not exact, especially in the cases of the three who had only seven illustrated stories each, but at least the fact stands out that, as I have often vociferously asserted, Schneeman is tops and Binder and Wesso stink.

Especially Binder. So help me, I could go on for pages and pages about how completely and utterly devoid of any useful quality his stuff is. I infinitely prefer no illustrations at all to illus-

A SNAPSHOT MAY WIN FAME AND FORTUNE . . .

"PIC" Selects Show Girl to Appear in the Billy Rose N. Y. World's Fair Aquacade!

The shapely Show Girls in Billy Rose's N. Y. World's Foir Aquocode ore receiving rave notices from the columnists!

Your girl friend or sister moy be one of these feotured girls . . . beoutifully costumed . . . odmired by a tremendous oudience . . . on her woy to fome ond fortune. To enter this contest, all she hos to do is send in a full-length photogroph (on ordinory snapshot will do) of herself in a bothing suit.

The lucky girl selected every two weeks will receive $100. from "PIC" for expenses, ond Billy Rose will feoture her in his N. Y. World's Fair Aquacode as The Show Girl of the Nation ot $36.50 for one week. If he likes her work she will continue ot that solory or more.

Don't forget to tell the girls you know about this wonderful opportunity. For complete detoils ond an entry blonk, buy the lotest issue of

"PIC" ON SALE AT ALL NEWSSTANDS

trations by Binder. He has spoiled more good stories for me than I can remember.

And to conclude this little inspirational lecture, here's something that's too good to keep:

Excerpt from a letter written to a British science-fiction magazine: "Why don't you publish some 'mutant' stories. I don't quite know what they are, but they're awfully good and terribly popular in America."

More power and less Binder to you!—Damon Knight, 803 Columbia Street, Hood River, Ore.

Perhaps it's because the higher functions of man—reason and imagination—make up science-fiction?

Dear Sir:

I am one of those probably numerous ones who have read your magazine religiously without ever taking the time to write and say how much pleasure it has given me. I do not think it fair to you to neglect my duty longer. I do like Astounding immensely. The general quality of the magazine has improved wonderfully since you took over, Mr. Campbell—stories, format, art work, everything. I like your policy of occasional articles, too. "Design For Life" is as interesting as any feature in the May number. I am no art critic, but I like the cover on this one, too. You are definitely getting away from the lurid covers that used to make me a little ashamed to be seen with the magazine in my possession.

If I may express a preference for authors, it will be Williamson. I think "One Against The Legion" will be even better than the "Cometeers," which I thought especially well conceived and executed. As for types of stories, I have never got over a juvenile preference for interplanetary tales. Not cosmic warfare, necessarily; but stories which bring in characters and scenes from other worlds.

The unusually high level of the May issue makes rating difficult, but here is mine. I omit the serials until they are finished.

1. "Special Flight"
2. "The Day Is Done"
3. "Melody and Moons"
4. "Coils Of Time"
5. "Employment"

I am preparing for the priesthood. A good many priests of my acquaintance like science-fiction—more, I believe, than they do any other pulp magazine. I don't know just what that proves, but there it is.

Much success to you, and many more long years of achievement for Astounding—Grover Ables, Christ School, Arden, No. Car.

Year's rating of stories of 1938 so far: 1. "Who Goes There?"—Stuart. 2. "A Matter of Form"—Gold. 3. "The Master Shall Not Die!"—R. DeW. Miller. 4. "Anachronistic Optics"—Schere. 5. "The Dangerous Dimension"—Hubbard.

Dear Mr. Campbell:

While truckin' through Brass Tacks to the tune of "I-O, I-O, I've been a foolish lad," I tripped over Robert Mildren's short letter and fell flat on my face. The obstacle in my happy course was one little sentence: "Why did you publish rubbish like 'Anachronistic Optics'?" That sentence floored me for a while, but I am up and ready now. You see, that particular story was one that I liked best in 1938. I had even rated the stories of 1938 in this fashion:

1. "Who Goes There?"
2. "Anachronistic Optics"
3. "The Dangerous Dimension"

Here are three reasons, Mildren, why I liked the story in question well enough to place it second in my list:

1. It is unique. It has that *Esquire*like approach, that touch of satire, humor, and—most important—originality.

2. It is realistic. All fantasy or science-fiction must be realistic in action, character and situation. The characters are real: they are like people I could meet on the street within one block of the house. The story is filled with cleverly placed bits of local color or tags to character.

3. It is clever. Don't you feel the utter lack of stuffiness in Schere's tale? I think the author has shown the ability to suit the style to the mood.

Have you heard any of Raymond Scott's recordings such as "Powerhouse," "War Dance For A Wooden Indian," "Twilight In Turkey," and others? Well, he is to music as this story was to science-fiction. The more of that type and the less of these superspace yarns that follow in the same old rut of worldly and alien interplay the better.

Mildren, do you read Buck Rogers?—Donn Brazier, 3031 N. 36th Street, Milwaukee, Wis.

SCIENCE DISCUSSIONS

Hm-m-m—but a paper clip on the end of a rubber band may be moving pretty slow till it's released. Then it acquires kinetic energy in a hurry.

Dear Mr. Campbell:

I hope you won't think I'm dragging the matter out to unreasonable length, but there are a few things I would like to say about Willy Ley's letter which is printed with mine in the current —May—Astounding.

He has effectively disposed of the first point discussed—he is obviously right when he says spaceships *partly* shielded from gravity would travel in curved lines. In his February letter he speaks of "shielding the spaceship against the gravitational influences of whatever heavenly bodies happen to be around," and goes on to say that "in such case the orbits would not be straight lines." It seems hardly surprising that readers thought he meant complete shielding from gravity.

In regard to the second subject: Gravity shadows and the difficulty of getting objects in and out of them; I am puzzled by Mr. Ley's use of the term "kinetic energy." According to the physics texts I have seen, kinetic energy is possessed by objects in motion—it is energy they have by virtue of their motion. Mr. Ley states that a billiard ball rolling off a shield would suddenly acquire the immense kinetic energy of a body that had fallen from infinity. Yet the ball is practically at rest.

When a meteor falls to earth it comes in with tremendous kinetic energy of the order he speaks of, but when it has come to rest it no longer has it—its energy has been used in passing through the air and burying itself in the earth. When it is at rest it has no more kinetic energy than any other body at rest on the earth's surface—that is, none.

Mr. Ley also speaks of putting this energy into the billiard ball before it is placed on the shield. But how could this be done? Energy is always associated with motion, and so how could a practically stationary ball have this tremendous energy imparted to it? A stationary object may be subjected to stress or pressure, but if no part moves it does not gain any energy or capacity to do work.

If gravity shadows really would be an almost impregnable protection against projectiles, they should be mighty handy things for science-fiction

anthors. I wonder if ye editor couldn't clear this up in a few words.

Here's my vote on the stories:

1. "One Against The Legion"—mainly an account of Giles Habibula.

2. "Design For Life." You really should allow this a rating even though it is an article.

3. "The Day Is Done," by Del Rey.

4. "Melody and Moons," by Kent Casey—D. R. Cummins, 221 Jay Street, Sacramento, Calif.

You can't prove rotation that way, because the contraction affects everything—including your instruments. Wherefore your measurements show nothing.

Dear Editor:

Because I wasn't reading Astounding Science-Fiction at the time "The Irrelevant" was published, I cannot comment on that part of Robert Swisher's discussion relating to the latter; however, I can prove his quotations and what-nots—to the effect that, if in the case of a body revolving about a certain point the rest of the cosmos is eliminated, centrifugal force will not manifest itself—to be false in logic.

What surprises me most is the fact that Mr. Swisher quoted such an error from a book whose author mentioned "Einstein" in the title! As I remember it, the quotation was to the effect that because the event consisting of a body revolving about a given center can be judged to occur only by viewing the given body's velocity relatively to the rest of the universe, if the latter were eliminated, there would be no effects of centrifugal force. But that is not so, because even if everything else were instantaneously wiped out, the body's velocity, or that part of the latter having to do with a circular motion or orbit, could be perceived relatively to the body itself. Remember the Lorentz-Fitzgerald contraction, Mr. Swisher? Now consider the fact that the characteristic of any revolving body is a greater velocity for points at a greater distance from the center of revolution than others. Catch on now? That part of the body at a greater distance from the center of revolution than another given part will undergo a greater contraction ratio! Consequently a circular orbit will manifest itself in reality, *regardless of anything else.* Of course, such an orbit has to be assumed to be hypothetical, for actually if the center of the orbit were annihilated with the rest of the universe, the body under consideration would partake of a velocity tangent to its former one.

Another thing: If Robert Hansen does not like science, why does he read science-fiction?—Casimir F. Pierog, 7605 Osage Ave., Cleveland, Ohio.

How many is a crew?

Dear Campbell:

A word or two re my own recent yarn may be of interest and stir a bit of controversy. Ordinarily I'm sgin' sequels—as distinct from series-stories built around a character like Johnny Black or Giles Habibula—and that was the real reason why "Coils of Time" started off so far from "Sands of Time." Another very good reason is that not enough is known about dinosaur days to make a straight sequel different enough to be of interest—to me at least.

But that isn't the point. As "Coils" was being finished the well-known flaw-spotter, L. Sprague de Camp, looked over the manuscript and objected strongly to something which in my opinion is entirely controversial. He says it would take a crew of at least eight men to run a good-sized spaceship. Naturally, I claim that Adams could do it single-handed.

If this develops into an open controversy, I have no doubt that my critic will want to do his own arguing, but, as I remember them, his points of reason were about as follows: 1. One man couldn't run a spaceship because it would be too big a job for him to handle physically, any more than one man can run an ocean liner. 2. The best part of his argument in my opinion—there should be at least three shifts to give the crew a chance to sleep. 3. Out of logical order, I'm afraid—specialization would demand extra men, such as a cook, a navigator—astrogator?—mechanics, officers, and what have you. I tried to find the scribbled list he made out at the time, but I know he made eight men the minimum.

My rebuttal hangs on one thing: mechanization, with a dash of economy. I didn't, as a matter of fact, say that any spaceship could get along with one man for crew, but why quibble? By the time we have spaceships that can be maneuvered with freeness comparable to our present ocean liners, we will have automatic machinery that will do anything a man could do, and will be using it.

In the first place, a spaceship has invisible controls on it in the shape of gravitational forces from the sun and planets, which swing it into an orbit and keep it there. Once you've decided where you want to go and selected the orbit that will take you there by the cheapest route, you bring your velocities up to the proper values at the proper time and in the proper place—and then go pick up Billingsley Shropford's latest adventures, while the ship coasts. There's no need to monkey with the controls unless you want to dodge or chase something. Automatic machinery can probably react much faster than you can—or I—or Mr. Adams.

Must there be one man to navigate, one man to cook, one man to fix things, and one man to boss everybody? Maybe on a space-liner with union labor and tradition setting its pace—you'd need stewards, male and female, too, and a doctor—but boiled down to essentials, on an experimental ship—no! A pilot who couldn't figure out how to get where he was going, couldn't hash up his own victles, and couldn't hoss himself would not be good space material.

I'll grant Mr. de Camp this—he'd have a much easier time with a companion to take over while he slept—it was the double shift business that brought my opponent's list up to eight men—but the same automatic machinery that he would rely upon when awake could take over when he was asleep, and wake him for emergencies. Unless life in space is one long string of emergencies—in which case I see little chance of popularity for space flight—our one lone man ought to be able to get in his forty winks. Besides, I believe that a number of short cat naps are better for you than one long snore, particularly if you don't get much action.

But, in any case, I'd really like to see argument on the subject, and maybe even an article by Willy Ley or the mathematically acute Mr. Swisher, if he can write as well as he argues. It may turn out reference material for writers of the sort that De Camp is doing in his article.

A word on *Unknown.* I have only just started the issue, but I think I may find room for argument over some of the Neanderthalisms in "The Gnarly Man"—a swell yarn, but not as good as the De Camp serial. I have a feeling that the poor brutes weren't as poor or as brutish as they're cracked up to be. Mousterian implements show real skill and workmanship in flint-working, albeit rather high specialization. If the story had been in Astounding, I'd crack down.

A good story is what we're after. There was a time when Astounding led the field in a race for screwy super-scientific "ideas" that dragged the plot after them like a kite's tail. The result was dizzying, but sort of hollow. With good writing—good stories—good pictures—*and* good ideas, there need be no fear of retrogression.—P. Schuyler Miller, 302 So. Ten Broeck St., Scotia, N. Y.

WHEN THE HALF GODS GO—

By AMELIA R. LONG

WHEN THE HALF GODS GO—

The Martian had a nice idea—just make himself a god to the Venusians. Very clever—but it backfired!

By Amelia R. Long

Illustrated by Orban

SPORS ROK, the Martian, was a believer in the adage that a religious people is the easiest to govern. He knew that it had proven true on his own planet, where it had once been necessary to wipe out a whole nation of atheists in order to prevent them from spreading dissatisfatcion among their neighbors. He knew, too, that it had been true upon Earth, where a belief in "the divine right of kings" had helped keep subjects to heel until practically modern times. In addition to this, he knew that the Venusians were a highly religious people, setting great store by their local gods. So in the custom of all Martians, he began to associate these thoughts; and they gave him an idea.

Accordingly he took one of his lieutenants and a small party of escorts, and went to visit the tribe of Blue People who lived on the free land between the Terrestrian and Martian settlements.

The Blue People received him and his party with much politeness; for although they were nominally under the protection of the Terrestrians, they knew from past experience that the Martians were a very definite force to be reckoned with. After gifts had been exchanged, the feast of guests—customary among the Blue People—partaken of, and much flattery wasted on both sides, Spors got down to business.

"O Chief," he began, addressing Ambella, who was the ruler of this particular tribe of Blue People, "you are a mighty king."

"My brother from the Red Star speaks but the truth," said Ambella, knowing very well that he lied.

"But," continued Spore, "with the proper guidance, you might easily become an even greater king."

"How?" inquired Ambella with the directness of his kind.

"Since before the coming of either the men from the Green Star or those from the Red Star," the Martian went on, "your people have worshiped the god Lalu, who sits in the form of a stone image in your temple. Now Lalu did well enough in his way, for all people must worship something; but he is not a real god, and, therefore, cannot make you a powerful king."

"Now may Lalu pardon you, my red brother!" gasped the scandalized Ambella, devoutly making the sign of an egg, which on Venus as on Earth is the symbol of life, and consequently of God. "Surely you have spoken that which you cannot mean; for no man would speak against the great god Lalu for fear his tongue would be turned into a little snake, and sting him to death!"

But the Martian only smiled. "When I said that Lalu was not a true god, I meant it," he declared. "What has he ever done to prove to you his divinity?"

"He has kept me and my people fed

when the crops of our neighbors failed."

"That," replied the wily Spors, "was the result of your own cleverness and industry, and not the gift of Lalu. And now, because you are so clever, I am going to tell you a great secret."

He leaned toward the Venusian and spoke impressively.

"We, the people of Mars, are the true gods. Worship and obey us, and you shall become all-powerful."

Ambella's china-blue eyes grew round, and his indigo eyebrows arched in questioning incredulity.

"But . . . but," he stammered, "you are a man like me. How can you be a god?"

Spors smiled thinly. "Did you ever," he inquired, "see a dead Martian?"

Ambella had to admit that he had not; for it is a custom of the Martians when colonizing another planet never to let the death of any of their numbers become known.

"But," added the Venusian chief, who was not altogether a fool, "neither have I ever seen my maternal grandfather, yet I know that I must have had one."

Spors had been expecting something like this, but he pretended to be angry. "Graceless one," he said, "I should punish you by leaving you to the mercy of the Terrestrians, who will one day eat you up. But I like your spirit; so instead I will prove to you that what I say is true, and give you an opportunity to worship us Martians, and so become great."

"How?" again asked the practical minded Ambella.

"By demonstrating that Lalu can be destroyed, while we Martians cannot," answered Spors. "Come to the Temple of Lalu at midday tomorrow, and you shall see that which will prove to you who is God."

THE following midday found the stone temple on the edge of the village packed to the doors, for the news of the Martian's boast had spread like wildfire. The Blue People are a highly imaginative race; and on this occasion many of them had traveled as far as a hundred miles with the firm expectation of seeing the blasphemous Spors and his companions blasted into atoms by the outraged Lalu. When it was physically impossible for another person to be crowded into the temple, Spors rose and mounted into the triangular holy place usually sacred to Ambella, who as chief was also high priest.

"Oh, my brothers," he began in a tone that filled the great hall, "it was once said by a great philosopher of the Terrestrians that when the half gods go, the gods arrive. And it is a true saying, as I will show you presently. For when I have cast down Lalu, you will realize that I am indeed the true god, and have come from my home in the Red Star to rule over you and lead you to greatness."

He paused to observe the effect of his words. On more than half of the faces before him was a look of pious horror, while upon others was an impatient questioning that Lalu did not squelch him at once, and have done with it. Some few made a threatening move toward him, but were held in check by the very enormity of his blasphemy.

"And now," Spors got down to business at once; for with a Venusian crowd it is useless to waste time and words in elaboration of details, "I will take my little tube that makes good-by forever, and show you that Lalu, whom you have believed to be indestructible, can be destroyed."

He unslung his ray-gun; and while the spellbound populace looked on, leveled it at the stone image. There was a blinding flash as he released the power —and the two-ton Lalu, together with a section of the rear wall, floated lithesomely upon the noonday air in the form of a fine gray dust.

There was a gasp of horror from the

audience, and some three thousand Blue People turned a pale shade of forget-me-not.

Spors waited until the excitement had abated somewhat; then he spoke again.

"Behold," said he, "I have destroyed the stone image, Lalu. Could I have done this if he were indeed a god? Can a god die, or be destroyed?"

A timid and reluctant, "No," was breathed by the more venturesome spirits present.

"Then by the same sign," shouted the Martian opportunist, "behold proof of my own godship!"

Turning the ray-gun upon himself, he released the power.

For the space of a full minute he stood bathed from his shoulders down in the blinding white light—and nothing happened!

Beholding the miracle, his audience swayed dizzily, and seemed about to faint en masse. Then Ambella, like a man hyponized, came forward from his place in the front ranks, and knelt at the Martian's feet.

"You are God," he said humbly. "I and my people acknowledge it."

Spors smiled patronizingly. He found it unnecessary to explain that his garments were made of the new, clothlike mineral, etherium, the only substance known that is able to resist the destructive power of the disintegrating ray.

"SOMETHING," Commander Fox remarked to his fellow officers at the Terrestrian colony, "has got into the Blue People. During the past two or three weeks, they've canceled all their trading agreements with us, and have even forbidden our people to travel across their territory. I'm afraid they're getting ready for some kind of mischief."

Subcommander O'Connell looked up with interest. "Ye might let me sail over them with the little rocket plane and drop a few itch bombs," he suggested helpfully. "Sure an' that would keep them so busy for a while, they wouldn't have time to be thinkin' up any devilment."

Fox smiled, but shook his head. "I'm afraid that wouldn't do, Pat," he said. "Mars is just waiting for such a move on our part to charge us with mistreating our protectorate. If they could work up any kind of case against us, they might induce the interplanetary court to make them the guardians of the Blue People instead of us; and that's what they've been after ever since the colonization of Venus was begun."

"Maybe," suggested Subcommander Schneider, "it would be a good idea to drop some itch bombs on the Martians; hein?"

"I wish I could," Fox admitted.

But until some definite move was made either by the Blue People themselves or by the Martians, who were unquestionably behind them, it was impossible for Fox and his little company of Terrestrians to do anything without becoming technically the aggressors, and so placing themselves in the wrong.

Meanwhile the thinly veiled hostility of the Blue People grew stronger and stronger. Occasionally there floated through the tangled, tropical jungle beyond which they dwelt rumors of a great religious revival around a new and powerful god; but there was never anything definite.

Schneider sniffed disdainfully when he heard about it. "Religion!" he exclaimed in disgust. "Bah! It is a nuisance! Will people never learn better!"

O'Connell put down the pipe he had been smoking. "Go away with your atheism!" he commanded. "Ye may admit that ye have no soul yourself if ye like, but ye needn't think we're all as benighted as you are."

"I'd like to get a look at this new god," Fox remarked. "I believe that if we could learn more about him, we might understand what's going on."

"Did ye know," asked O'Connell with seeming irrelevance, "that the Blue People are turning over to the Martians all the radium ore that they used to sell to us?"

"Are you sure of that?" Fox asked quickly. "I thought the Martians had refused to pay the Blue People their price."

"Whether they pay the price or not," O'Connell answered tersely, "they're getting all the ore and everything else worth havin' in the Blue People's territory."

Fox was silent for several minutes; then:

"I suppose I'll have to fly over to Ambella's village and see what's going on there," he decided. "If the Martians have begun to interfere with our trade treaties, something will have to be done about it."

BUT that particular visit was destined never to be made. On the very morning that he had planned to start, Fox was stricken with an attack of Venusian fever, which, while it is not an especially dangerous disease, makes him who has it believe that he is a winged lizard, and attempts to fly. Consequently, he is not in a condition to carry on negotiations that may be of interplanetary importance.

"I'll have to send one of you fellows in my place," he said when he realized that the fever was upon him. "I'm liable to be down with this confounded idiocy for a good two weeks; and there's no telling what might happen in that time."

"I'll go," O'Connell offered. "If it's a good lesson those blue divils are needin', sure an' I'm the man to give it to them."

But Fox shook his head. "That's just what you're not, Pat," he declared. "Apparently the Blue People already have a chip on their shoulders. If you go over there now and start laying down the law, they'll go howling to the Martians in protest; and that's the very thing we want to avoid. We must find out what the trouble is without antagonizing them." He turned to Schneider. "Do you think you can handle them, Adolf?" he asked.

"I'll try," Schneider promised. "What is it I should tell them?"

Fox considered. "Better not tell them anything definite," he decided. "Just try to furnish them with some new interest to keep them occupied until I can get to them."

"But see that ye keep your tongue away from the subject of atheism," O'Connell advised, "or ye'll be gettin' us all murdered."

"Yes," Fox agreed with a faint smile. "I'm afraid it wouldn't be a very diplomatic subject, under the circumstances."

That afternoon, Schneider set off in the small rocket plane for the village of Ambella. By that time Fox, in whom the fever had developed rapidly, was attempting to make short flights from his bunk to the table, and had to be restrained forcibly by O'Connell.

For the next ten days, the commander of the Terrestrian outpost was a very sick man; and his second had his hands so full with him that he had little time to think of his brother officer and his good-will visit to the Blue People. It was not until the morning of his fifteenth day, when Fox sat up in his bunk and with his first lucid breath demanded news of Schneider, that O'Connell suddenly realized that there had been no word from him.

"No word?" Fox repeated. "I don't like that."

"I don't meself, now that ye mention it," O'Connell admitted uneasily. "There's no radio in the plane, but he took along four carrier pigeons. He could have let us know something, surely."

"Has there been any word of the Blue People?"

O'Connell shook his head. "Whatever they're up to, they're keepin' it to

themselves," he replied. "Even the Martians aren't doin' business with them any more, 'cordin' to two of our traders, who stopped here a few days ago."

Fox frowned. "That sounds bad," he declared. "Get the large rocket-plane ready to travel at once. We're going after Schneider."

"But ye're not fit to travel yet, sir," O'Connell protested. "Let me—"

But Fox waved aside his objections. "I'm fit enough," he interrupted impatiently. "Do as I tell you. There's no time to lose."

In spite of all O'Connell's protests, the slim, gray form of the rocket-plane was wheeled out of her hanger, and Fox, still pale and a trifle shaky from his recent illness, got aboard her with his sub-commander. From her top, just below the long, finlike blades of her autogyro propeller, which she used when flying within the planet's atmosphere, jutted the ominous black muzzle of a newly mounted disintegrating ray-gun. Fox was going prepared for trouble.

Under O'Connell's controlling hand, the blades of the propeller whirred into a blurred vortex, and the rocket-plane rose almost vertically into the air; then darted off toward the east, flying high in order to clear the saw-toothed mountain range that separated the lands of the Terrestrian colony from the jungle-covered freelands, beyond which was the native village of Ambella and his tribe of Blue People.

Once they had crossed the mountains with their deep, unexplored caves where dwelt the flying lizards—creatures half bat, half salamander, with a wing-spread of nearly four feet—O'Connell dropped the plane until they were almost skimming the saffron colored tops of the lush jungle trees. There was just a chance, he pointed out, that Schneider had never reached the village of the Blue People at all, but had been forced down somewhere en route. If this was the case, there was, of course, little hope of finding him alive; since he would either have lost his way in the dense jungle, whose rapidly growing vegetation made it impossible for any path cut through it to exist for more than twenty or thirty hours; or he would have fallen prey to some one of the strange creatures of Venus, most of which displayed a remarkably unpleasant ingenuity in their methods of destroying whatever living thing they encountered.

There was, for example, the animal resembling an oversized anteater, whose favorite diet consisted of brains, preferably human, which it devoured by dropping unexpectedly from some tree upon the shoulders of its victim, and inserting the end of its razor-sharp snout at the base of his skull; or there was the giant lizard, not unlike the Tyrannosaurus of the Terrestrial Pleistocene Period, that could put an ordinary saber-toothed tiger to shame. Or, worse of all, there were the "mushroom seeds"; little blobs of whitish matter, half carnal, half vegetable, that would fasten their claw-like roots into a man's flesh, and deposit their spores under his skin before they could be shaken off. A few hours later, a grayish, slimy mold would form over all parts of his body, and would grow with such rapidity that within two days he would become a hideous, walking mass of white fungus. Fox had once encountered one of these "dough-men," as they were called, and had mercifully given him the release of the ray-gun.

THE PLANE cleared the outer fringes of the jungle and crossed the broad river, that bounded the lands of the Blue People on the west, at the hour of siesta; which, because of the semi-tropical climate of Venus, with its oppressively midday heat, is observed almost universally throughout the planet. Straight ahead, about a mile distant, lay the village of Ambella; a collection of some two hundred or so rude huts, built in a double circle around a large central

clearing. From a spot at the exact middle of this clearing, a spiral of lazy smoke was rising.

O'Connell touched Fox's arm to draw his attention to the smoke.

"Look, sir," he said. "They've been having a powwow of some sort. The council fire is still smoldering."

Fox nodded. "I only hope it doesn't mean mischief," he said soberly. "They only hold a Big Fire, as they call it, when they are choosing a new chief, contemplating war, or trying one of their number for some capital offense; and in any of these cases, we are supposed to be notified first."

"Perhaps it's only some of their new religious rites," O'Connell suggested; but Fox disagreed.

"In that case, they'd have held it at the stone temple over there on the hill," he replied. "No, Pat; this was something civil. I only hope that Schneider's all right," he added half under his breath.

O'Connell set his jaw grimly, and headed the plane for the village. He circled it once; then, at Fox's direction, dropped like a plummet into the cleared central space, coming to rest beside the ashes of the still smoldering fire.

A series of startled squawks arose from the nearest huts; and some twenty-five or so blue heads appeared in the low doorways. Fox and O'Connell made no sign, but sat stiffly erect in their plane; for, with the people of Venus, to speak first on such an occasion is to admit your inferiority.

Almost immediately the heads were withdrawn again; then, after a brief pause, Ambella himself appeared at the door of the largest hut, and advanced slowly toward the plane. He was garbed simply but strikingly in the costume that he reserved for all important occasions: a pair of plaid plus-fours, the tall hat of a British grenadier, and a necklace made of American safety-match folders strung upon a shoe lace. He clasped his hands about his stomach and bowed three times in formal greeting; then he spoke.

"The White Father Who Knows All is thrice welcome," he said politely. "He and his brother do us great honor."

Thank you, Ambella," Fox said without smiling. "And now, where is my other brother, who came to you fifteen suns ago?"

Ambella was all suavity. "He of the Three Eyebrows is asleep in his house," he replied, using the native name for Schneider, whose small mustache was a never failing source of wonder to the hairless faced Venusians. "I will take you to him."

"No," said Fox, who was not quite sure whether the chief was to be trusted or not. "You will bring my brother here to me—now."

"It shall be as my White Father wishes," Ambella agreed. He turned to one of the Venusian warriors who had followed at a distance .and directed that Schneider be summoned.

"All right so far," O'Connell whispered in English while they waited. "Still, I've a feelin' that Ambella's got something up his sleeve."

"If my White Father is wondering why the little birds do not fly," the chief put in, sensing that something was amiss, "let me explain. The sun after He of the Three Eyebrows arrived, the Red One came to visit my people. He fancied the little birds; and one of my warriors, not knowing to whom they belonged, gave them to him. I was very sorry when I learned of it, but then it was too late."

"So Spors Rok has been here!" O'Connell exclaimed. "I knew he was behind it all, the red divil!"

"Quiet," Fox warned. "Here comes Schneider. He'll explain."

SCHNEIDER was approaching in company with the two warriors who had been sent to fetch him. Ambella and his

men tactfully withdrew out of earshot in order that the Terrestrians might talk together.

"Quick, Adolf," Fox demanded, "what are they up to? Have you found out anything?"

Schneider shrugged. "I am not sure," he replied guardedly. "They have treated me with every courtesy; but twice since I have been here, Spors Rok and his lieutenants have come, and held conferences with Ambella, to which I was not invited. As you instructed me, I have not spoken to the Blue People upon political matters."

"I know about the Martian's first visit, Fox said. "When was the second?"

"Last night."

"Then they must still be here!" Fox exclaimed. He signed for Ambella to join them. "My brother tells me that my cousin, the Red One, is here," he said. I would like to see him, to give him my greetings."

A glint of relief shone in Ambella's eyes, but was hidden almost immediately. "Most certainly, O White Father," he agreed, bowing. "I myself will conduct you and your brothers to his house."

Too late Fox realized that he had committed a tactical blunder. To demand that Spors Rok be brought to him, would be a breach of diplomatic etiquette that the Martian would be only too quick to resent; while if the Terrestrians went to him, they would have to go unarmed, since it is considered an affront for the leader of one colony to carry arms when making a supposedly friendly call upon the leader of another. But it was too late to back out now; he would have to go through with the situation.

"Very well," he said. "Take us to our Red Cousin."

Ambella bowed, and conducted them through the double row of huts to a somewhat larger one standing a little apart from the others. "In here," he invited, standing aside for them to enter.

Somewhat warily, the three Terrestrians crossed the flat threshold into the hut's dim interior. In the uncertain light, they could see tht it was furnished with the brightly colored, woven mats and low, wooden table of the conventional Venusian guest house; but save for themselves, it was unoccupied.

Fox turned sharply upon Ambella. "Where is my Red Cousin?" he demanded. "I do not see him."

Ambella smiled blandly. "I go to bring him," he replied, and withdrew, leaving two of his big warriors outside the hut.

The three Terrestrians glanced at one another inquiringly, but none of them spoke. The situation was decidedly uncomfortable; yet they had to admit that so far nothing had occurred which, under ordinary circumstances, might be looked on with suspicion. It was quite likely that Ambella, in bringing them to this uninhabited guest house, had merely done what he considered a more diplomatic thing than obliging them to go directly into the presence of the Martian commander.

Nearly twenty minutes passed; then three natives, carrying large covered trays, appeared in the doorway.

"The Red One is delayed," the foremost of these explained. "Meanwhile, the Prince Ambella sends his deep respect, and asks that you refresh yourself while you wait."

He removed the coverings from the trays, revealing dishes of raw lizards' eggs, a boiled vegetable not unlike earthly cabbage, and an unsavory mess, which the Venusians called *mula*, the content of which was a dark mystery to Terrestrians. There was also a jug of milk from the little three-horned cattle of Venus.

"If the spalpeen is after poisonin' us—" O'Connell began when the three natives were gone; but Fox put the suggestion aside.

"I don't think we need fear anything

like that," he declared. "If he had any such intentions, he'd have disposed of Adolf long ago. It's likelier that he, or rather Spors Rok, will try to force us into signing some agreement favorable to the Martians; or that they may hold us here as hostages until they get what they want. But even that would be highly dangerous, and Ambella knows it."

They ate the boiled vegetables and drank the milk; but the lizards' eggs and *mula* they discreetly buried in a hole which Schneider dug in the dirt floor with his clasp knife. Then they resigned themselves to await whatever was to come.

AFTERNOON gave place to twilight and twilight to dark; and still no one approached the hut. Through the open doorway, they could see lights moving about the village; while sounds of excited voices told them that something momentuous was afoot; but they had no way of telling what it might be.

Suddenly a sound like the noise of a thousand rattlesnakes shaking their rattles arose from a point at the center of the village. Fox raised his hand for silence.

"The ceremonial rattles," he whispered. "Whatever they're up to, it's about to start."

Tensely the three men sat listening while the weird rattle rose and fell in monotonous, rhythmic cadences. Presently Schneider, who was a student of the Venusian rattle language, spoke.

"Leiber Gott!" he gasped, forgetting in his excitement that he had not long ago declared himself an atheist. "That is the summons to sacrifice! I have heard it in the early days, when some of the Venusians were still cannibals."

O'Connell half rose from the mat where he had been sitting. "Divil an' all!" he exclaimed. "I'll not be an Irish stew for any Venusian! If we jump this lad outside the hut—"

"Sit down," Fox commanded sharply. "If you do anything like that, you'll only precipitate matters. If we're to get out of this, it will have to be by use of our heads, not our fists." He turned to Schneider. "Are you sure about the rattles, Adolf?" he asked.

"I only wish I wasn't!" Schneider answered fervently. "But there's something strange about them," he added after a moment. "They are not telling the name of the god to whom the sacrifice is to be made."

"Lalu, probably," Fox muttered. "He's the tribal deity. But it's odd they should be assembling in the village, and not at the temple."

An hour passed, during which the sound of the rattles continued uninterrupted. Presently it was augmented by a low, ritualistic chanting that was even more ominous in its suggestion. Then the tempo of the two grew faster and faster, until it had become a very whirlpool of sound.

Fox and his two companions crouched in the darkness of the hut, awaiting they knew not what. They had abandoned all hope that the Venusians would not dare to put them to death, for they realized that in their present state of savage frenzy, the Blue People would act first and consider the consequences of their deed afterward. Although, there was a native oil lamp upon the table, the Terrestrians had decided not to make a light; since that would render all their movements visible to a possible watcher from without, while it would make it impossible for them to see anyone who might approach the hut.

Between them, they had formulated a course of action; pitifully poor, but the best they could do under the circumstances. When the guards came for them, they would go to the council circle without protest; then, while Fox attempted to engage their captors' attention, Schneider and O'Connell were to make a dash for the plane, in the hope

that one of them, at least, might be able to reach it and bring the disintegrator gun into play.

"Of course if they bind us, we can do nothing," Fox had concluded. "But we can only hope that in view of their superior numbers and the fact that we are unarmed, they'll not consider that necessary."

"Spors Rok is at the bottom of all this!" O'Connell exclaimed bitterly. "But I don't understand how he dares—"

"Spors is risking little or nothing," Fox told him. "If they succeed in disposing of us, he will deny all knowledge of it; while if any of us escape, he'll insist that he was powerless to interfere. Ambella alone will be made to shoulder the blame."

While they had been talking, the chanting of the Blue People had stopped, and the sound of the rattles had become more subdued. Suddenly a wild, high-pitched shriek of mortal terror split the air, only to be as quickly choked off!

"By all the gods!" O'Connell gasped. "What was that?"

The three sprang to their feet and stood waiting, suspecting that the moment of climax had been reached. But nothing happened. Only occasional sounds from the center of the village, combined with the faint glow of the fire that filtered between the huts, told that the council was still in progress.

SLOWLY the long hours of the night drew to a close, and the false dawn of Venus began to paint the sky with broad bands of amethyst and rose; and still no one came. Then, just as the true dawn was announcing the appearance of the sun above the horizon, a somewhat bleary-eyed Ambella presented himself at the door of the hut. He was alone.

"May my White Father and his brothers forgive me!" he exclaimed, and to their immense surprise, prostrated himself at their feet. "I had many things to attend to, and so my small, weak mind forgot about the presence of the Great Ones."

Fox did not contradict him. "Ambella, I am still waiting to see my Red Cousin," he reminded with a meaning look at the chief.

Ambela rose, but did not meet Fox's eyes. "The Red One and his companions are no longer here," he mumbled. "They . . . they have gone away."

"That," said Fox, "I cannot believe;

for if they had gone, I would have heard the sound of their wagon that flies."

Ambella's glance shifted from one corner of the hut to another, as if seeking a way out of some difficulty. "They did not go that way," he managed finally. "And now if my White Father, who is the sun and the stars and the cool winds

that blow at early morning, will do me the great honor to come with his two brothers to my house, we will have breakfast."

Fox nodded. "I think it's all right," he said in English in reply to Schneider's questioning glance. "If they wanted to kill us, they would have done it last night. I've a feeling that we'll find out what all the trouble was about once we have broken bread with him. You know the customs here."

They allowed themselves to be led to the chief's house, where a breakfast of milk, fruit, and, oddly enough, American pretzels was served by two uneasy-looking Venusians. When it had been eaten and the wooden dishes removed, Fox spoke.

"Now, Ambella," he began, "there are some questions that I must ask you. First of all, what has become of my Red Cousin?"

Ambella shifted uneasily upon his mat. "My White Father has eaten with me at my table," he said insinuatingly. "He is not angry with me?"

"I am your White Father; I am never angry with my children unjustly," Fox compromised. "Now tell me, where is Spors Rok?"

For the first time that morning, Ambella's eyes met the Terrestrians. "O White Father Who Knows All," he began, "I have a confession to make. Nearly a hundred suns ago, Spors Rok came to us and told us that he and his people were gods, and must be worshiped. He made us think that this was so by destroying our old god, Lalu, with the little-stick-that-makes-good-by-forever.

"Then I and my people, in our foolish ignorance, began to worship him and his people, and let them take away the little stones that see in the night. And White Father," here he had the grace to lower his eyes, while a deep cerulean blush stained his cheeks, "we even turned away from you; for the Red One said that we must do this, and we believed that he was God."

"Well, I'm a son of a flying lizard!" O'Connell burst out with indignation. "So that was his game! The dirty so-and-so!"

"But all that is changed now," Ambella hastened on; "for then came to us he of the Three Eyebrows, who opened our eyes to all our ignorance and wickedness."

"Me?" Schneider asked in surprise. "But I never spoke of the Martians to you, Ambella."

"No," Ambella agreed; "but you told us that there was no god that we could see or touch, but only a thing which was called natural law.

"And natural law could not be broken or destroyed in any way whatever."

"So you couldn't keep your ugly mouth shut about your godlessness," O'Connell remarked sourly to Schneider, "even after meself and the commander had warned ye."

"Never mind, Pat," Fox cut in. "It seems to have good results in this case." He turned back to the Venusian chief. "And so you told Spors that you no longer believed in his godship?" he queried.

"Oh, no!" Ambella looked shocked. "To have told him that he spoke words which were not true, would have been impolite. But we proved to him that he was mistaken."

"But how, man?" Fox was growing impatient. "Get on with your story."

"It was quite simple, O my Father. It is well known that a god cannot die or be destroyed. And so," Ambella paused, and passed the tip of his tongue over his lips, with the air of the cat that has just swallowed the canary, "we . . . we tried and found they could be—killed."

GEOGRAPHY FOR TIME TRAVELERS

On the scale of geologic times, old Earth heaves and quivers and shifts pretty rapidly. If you know the map of the Earth—try finding something recognizable on the map of a hundred million years ago!

By Willy Ley

Illustrated by Willy Ley

THE small airplane was tumbling downward through the rarefied layers of the upper stratosphere, much in the same manner as a wounded seagull tumbles to the ground. Its rocket exhausts spit fire furiously, the pilot of the plane fought with every bit of power at his disposal against his own speed. Finally the plane straightened out, the rocket blasts died down and two metal propellers began to project themselves from their protective sheathing in the wings. They began to whirl at high speed and the plane reluctantly followed their pull.

"Normal now!" said the pilot, with that peculiar mixture of shout and whisper that is often the result of nervous strain.

"Thank God," answered the observer. "You know I never liked that drop from a circling spaceship into an atmosphere. What's a mere crawl out in space is too damn much speed for a descending plane. How those wings stand it is beyond me."

"Well, they did. Now tell me what to do."

"Go down some more. Three miles above sea level will be about right. Meanwhile I'll have a look at the instruments."

The pilot set his controls for another three-mile descent while the other read various dials and gauges, noted down some figures and murmured things that might have had a meaning but did not sound as if they had.

"Strong magnetic field," he announced finally. "And it looks to me as if the magnetic poles of this planet are fairly close to the geographic poles. We can trust the magnetic direction indicator for the time being and make necessary corrections later."

"All right, I trust the magnetic direction indicator. What next?" asked the pilot.

"We are fairly close to what I believe to be the equator of this world. I think I saw a coast line when we came down. It must be south from our position. Fly south till you find it and then follow that coast line. About three hundred miles per hour. And, as far as I care, you may switch on the robot."

"Say," said the pilot after the robot mechanism had taken his work over and he himself had joined the observer near one of the windows, "you are always talking about 'this planet' and 'this world'—don't you know where we are?"

"I don't; *they* may by now," answered the other, making a gesture toward the sky where the spaceship was circling the planet outside the atmosphere and where the planetographers were doubtlessly working on a photographic map of the planet. "Anyway," he continued, "it should be a planet that has been mapped

Lower Cambrian Period, about six hundred million years ago. Three continents, three bleak and desolate wastes.

The line denoting the Equator on all maps shows its present location.

before. We were heading straight for home from those star clusters near the rim of our galaxy and should have arrived somewhere near our own solar System. Which means that there should be recognizable landmarks."

The pilot did not answer; he saw the coast line they had seen from higher up. It stretched beyond the horizon in a direction the indicator termed east and he adjusted the controls for following that coast line.

"You know," he said, coming back, "it may sound silly to you, but I don't feel at ease with that new method of space transection. First place, you only know that you get far—but you can never tell exactly where you'll enter normal space again. And those new researches on the mathematics of space transection hint that you may jump through a time warp as well as through a space warp. I don't like that business."

The observer did not answer directly. He was looking out of the window. It was a vast continent that stretched to the south, and a vast sea that stretched to the north. The sea looked like water —the spectroscopes had prophesied that much before nearing the planet—and possibly contained life. But the continent was one endless red desert—and if there was life it was too small and too scarce to be visible from an airplane. He glanced at a gravity meter; it registered not quite ten meters per second per second as the surface gravity of this world.

"Looks like Mars," mumbled the observer, "but it's much too heavy. Wonder whether *they* know where we are."

"THEY" did not know either. Up in the spaceship the commodore of the experimental vessel sat in serious conference with his experts. The course had been checked and rechecked, every

factor of uncertainty had been considered. They should be close to the Solar System. But they were not. The distances to the nearer stars did not fit in any astronomical pattern. The bright sun close to them resembled Sol, but evidently it was not Sol. The planets of that Solar System looked fairly alike to those of their own system. But they were not the planets they were looking for, and they did not correspond to any other known system either. And that third planet had in general Earth's dimensions but, if it bore any resemblance to any known planet, it bore resemblance to Mars.

There were three large continents. One that was long like a loaf of bread, almost circling the planet on its Southern Hemisphere. There was a sea circling the planet approximately along its Equator and there were two large continents side by side on the Northern Hemisphere. They looked like endless red deserts, formed by the slow disintegration of older mountains, colored by immense quantities of iron oxides. Compared to them the deserts of Mars, as the explorers remembered them, were only yellow with a red tinge; these deserts were *red*.

I LEAVE it for somebody else to finish the story. The plot is, of course, that the spaceship on its homeward journey traversed not only a space warp —if there is such a thing—but a time warp—if there is such a thing—as well. The explorers arrived home all right, but they were also thrown back through time a trifle—three hundred and fifty million years or so. What the explorers, those in the spaceship and the two that were sent to the surface in an airplane-lifeboat really saw was their own planet. But they failed to recognize it because none of them had in the excitement of studying far suns and planets and astronautics in general ever paid the slightest bit of attention to such a useless science as paleogeography. Whether somebody on board finally realized the truth and what good it did to them I do not know. And I don't care either. My point is that even nice and accurate maps are good only at the time they are made—and I am not referring to political maps.

But what I said about the general appearance of the Earth is correct. Our own planet *did* look like that three hundred and fifty million years ago, during the period geologists call the Devonian Period.

There were only three large continents, America and Asia in the Northern Hemisphere and Gondwanaland in the Southern Hemisphere, separated by the Tethys Sea, which for hundreds of million of years marked the approximate location of the Equator.

While this strange map of our planet is not the oldest that can be drawn, it is one that is very typical. In its general outline it prevailed for at least four hundred million years—not counting the six hundred and fifty million years of the Upper Precambrian Period, where the map probably looked the same, although we cannot be certain because we do not have all the data on hand that would be needed to trace the detail of the ancient coast lines.

The principle of mapping ancient continents and oceans is easy to understand and fairly simple. Rock folds tell of mountain chains even after the mountains themselves have disappeared for many millions of years. Ancient volcanoes can be detected either directly by lava flows or indirectly by the changes their heat wrought in the surrounding sedimental rocks. The sedimental rocks themselves tell whether they were formed at the bottom of an ocean or in a large fresh water lake. Rounded pebbles in fresh water sediments betray the action of swift flowing rivers, similar pebbles in different sur-

roundings tell of thundering surf. Fossils embedded in those sedimental rocks permit finer distinctions.

A certain type of rock may permit the conclusion that it was formed in salt water, meaning that a particular locality was sea bottom at a certain time. If oyster or other clam shells can be found in such rock, the general definition "sea water" narrows down to *"shallow* sea water." If there are coral formations present we can safely say: "shallow and warm sea water" because corals can live only under such conditions. The proper dating of the layer of rock, if not apparent from the rock formation itself, usually also relies on the fossils found in it. There are a number of fossils that serve this purpose so well and so frequently that they actually received the name of "leading fossils," because their presence always leads to proper dating and correct recognition.

While the principle is simple, the compilation of a paleogeographic map is by no means an easy job. Literally thousands of data are needed to trace, for example, the outline of the North American Continent during the Jurassic Period. Since the compiler cannot possibly check every single fact by personal observation, he has to rely on published reports and on the exactness and the training of the men that made them. But this "human element," dangerous and treacherous as it may be, is not the worst part of the story.

"Jurassic Period" means about thirty-five million years. It is true that there are three easily distinguishable sub-periods, but even so, a certain fact—say from the Lias formation, one of the three sub-periods—leaves a leeway of two million years or three. It is easy to visualize that a million years may cause very important and significant geographical changes, all within a sub-division of a well-known period. Small wonder that data sometimes seem to contradict each other, although they belong to the same time. They do, geologically speaking, because a million years means nothing

Upper Carboniferous Period, about three hundred million years ago. When life had just finished the conquest of land.

Early Triassic Period, about two hundred million years ago. Period of smallest ocean area on Earth.

to a geologist, but that same number of years might be very important to a geographer.

That millions of data are inaccessible at or below the bottom of our present oceans does not make map making more pleasant. And on top of it all there are the doubtful facts. Not those that are in themselves doubtful—they form another cute variety—but those that are doubtful in their interpretation. To illustrate this point I'll cite an example with which I am especially familiar for various reasons.

In East Prussia, directly at the shore of the Baltic Sea there occur layers of amber-bearing Blue Earth. They extend far out into the sea and even the small deposits that are now on dry land lie below sea level, about thirty or forty meters below the surface. The Blue Earth is, as I already mentioned, amber-bearing, in fact it is the only amber-bearing stratum known. There are fossils in the Blue Earth that tell a tale of a shallow sea, oysters, crabs, sea urchins and other creatures. The amber itself contains flies, ants, wasps, mosquitoes, beetles and other insects, even a small tree lizard is known. All of which seemed to prove that there grew a peculiar forest during the Oligocene Period —one of the sub-divisions of the Tertiary Age—in these parts, a forest that was likened to the mangrove forests of today. Later it was proved conclusively that the amber in the Blue Earth and the fossils in the Blue Earth had nothing to do with each other. The amber forest grew on dry land—nobody knows where—previous to the Oligocene Period, and its resin fossilized on dry land. But later the sea washed the amber pieces out of their original deposits, carried them away and embedded them into its own sediment—oligocene Blue Earth.

If any maps had been drawn before that proof was established, they had to be thrown away and to be redrawn as quickly as possible.

All this proves what immense amount of work had to be done by geologists

when they began to compile maps of the Earth of bygone periods. It also explains why the science of geology had to have progressed fairly far before a scientist could dare to draw the first of these maps.*

Later, when the maps for all the main periods of geologic history had been finished in outline scientists saw that Neumayr had accidentally started the work with the most decisive period. It was just during the Jurassic Period that the face of the globe changed from one pattern to another. The map of the Jurassic Period, looked at by itself, seems just strange and accidental. Regarded as connecting link between the Triassic and the Tertiary maps it acquires a very definite meaning.

But here we have to go back to the beginning.

IN THOSE days, almost two centuries ago, when the science of geology began to form vaguely in the heads of a few progressive and imaginative natural philosophers the beginning of Earth's surface was thought to have been a *panthalassa.* The word, derived from the two Greek roots *pan*—all—and *thalatta*—sea or ocean—denoted a sea without boundaries, an ocean that covered the planet completely. Slowly, it was thought, small islets began to rise from the panthalassa, growing and growing through the ages until the continents of today had formed. They would continue to grow, it was said, until one day there would be no ocean left on Earth, only an endless expanse of dry desert land, also covering all the surface of the Earth.

This trend of thought coincided nicely with the biblical story of creation; it was the philosophical version of the words of God: "Let the waters under the heavens be gathered together unto one place, and let the dry land appear." But then the idea of the panthalassa proved to behave like all other ideals, no place and no time could be found where it was fulfilled in actuality. First the Devonian Period was said to have been the time of the panthalassa. Then it had to be pushed backward in time into the Cambrian Period. Now we know that even the Upper Precambrian Period showed dry land although we are uncertain as to its extent. It is still possible—meaning that it is not yet proven one way or another—that there was a panthalassa during those nebulous days of the Lower Precambrian, but that is more a matter of belief than a matter of knowledge. The decision on this must rest on future discoveries.

At any event there were more than just a few islands looking from the oceans during the Cambrian Period, the time that is the first period of which we have reliable geological knowledge. There were already three large continents in existence. One of them representing roughly North America, the other representing a somewhat smaller Asia. The third one, however, is the most important one: *Gondwanaland.* It stretched from the Pacific Coast of present-day South America all across the South American continent, across the southern parts of the Atlantic Ocean, all over Africa and Madagascar, across the Indian Ocean and India till New Zealand. Just for the Cambrian Period it is uncertain whether it was interrupted east of present-day Africa, but probably it was not. At any event it was not interrupted in all the periods to come and it constituted the most conspicuous

* The map mentioned was the one of the Jurassic Period, drawn by Professor Melchior Neumayr. Our map, however, is *not* a reproduction of this first attempt. The world maps for the various periods as they are now in existence are the result of the labors of many famous geologists. Much of the preliminary work was done by Eduard Suess and Melchior Neumayr, while Koken, Lapparent and Frech—in his still very valuable *Lethoea polaeozoica*—continued the work which was finally again compiled and completely revised by Dr. Theodor Arldt in his book: *"Die Entstehung der Kontinente und ihrer Lebewelt."* The maps used to illustrate the present article are based on the works of Koken, Lapparent, Frech and Arldt.

feature of the face of the Earth for any period previous to the Jurassic Period.

Equally persistent and equally conspicuous as Gondwanaland* was the sea along its northern coast, the Tethys Sea, so named by Eduard Suess after Tethys, the mother of Okeanos and not to be confused with Tethys the mother of Achilles—she was graceful and beautiful and all that, but only a nymph—or with the one moon of Saturn that bears the same name.

Looking at the distribution of these three continents one notes that the main masses of land seem to huddle more closely together than they do nowadays. Even now we have clearly a land and a water hemisphere on Earth, but that difference was much more pronounced six hundred million years ago. It does not seem unreasonable to assume that in Precambrian days all the continents formed one single gigantic continent as Alfred Wegener taught. The first rift in that single original continent was in all probability the Tethys Sea—again a reasonable assumption if we remember that it followed closely the line of the Equator which seems never to have changed its position on the globe very much.

Life, at that time, existed only in the seas, the three continents were empty, in spite of all their immensity. We know that there must have been rivers because there must have been rain. We also know of a few mountain chains of the Cambrian Period and have traced some volcanic activity, but not many telltale traces survived six hundred million years of geologic changes, and what knowledge we have is more or less nebulous if it comes to details.

To be stranded as a time traveler on a Cambrian Earth would not necessarily mean quick death if the seashore is not too far away. The atmosphere would be breathable and there would be fresh water. There would also be what with some repugnance and hesitation may be called "sea food." But it would mean a life in weird surroundings, on a continent without life of any kind and without a sound except the shriek of wind, the thunder of electric storms and the pounding of the surf.

During the following two periods, the Silurian and the Devonian, there were many changes, but no improvements as far as the friendliness of the landscape is concerned. The general picture of the map remained the same, Gondwanaland extending all over the southen portion of the Earth's land hemisphere and America and Asia dominating the north. That the general picture remained the same, does not mean, however, that there were not many smaller changes, most noticeable on the maps of America and of Europe. Twice America was broken up into a number of colossal islands, once during the middle of the Silurian Period and then again during the middle of the Devonian Period.

The important point is that America, seen as a whole, was much larger than nowadays. While the Gulf of Mexico existed most of the time, the present large islands of the Caribbean Sea were almost always attached to Yucatan, forming a curved "tail" south of which the Tethys Sea ruled unbroken. In the north the American continent extended via Newfoundland and Greenland across the North Atlantic Ocean till Iceland, sometimes even farther. Europe had been separated from Asia soon after the end of the Cambrian Period; sometimes it formed an archipelago of large islands, sometimes it attached itself as easternmost peninsula to the North American continent.

Asia, while always large, was retreating steadily, and when the Carboniferous Period dawned it had retreated so far

* The name is derived from the Indian tribe of the Gonds and the Sanskrit word for "land" —*wana*. Gondwanaland is, therefore, a pleonasm, but there is little hope of changing the usage—

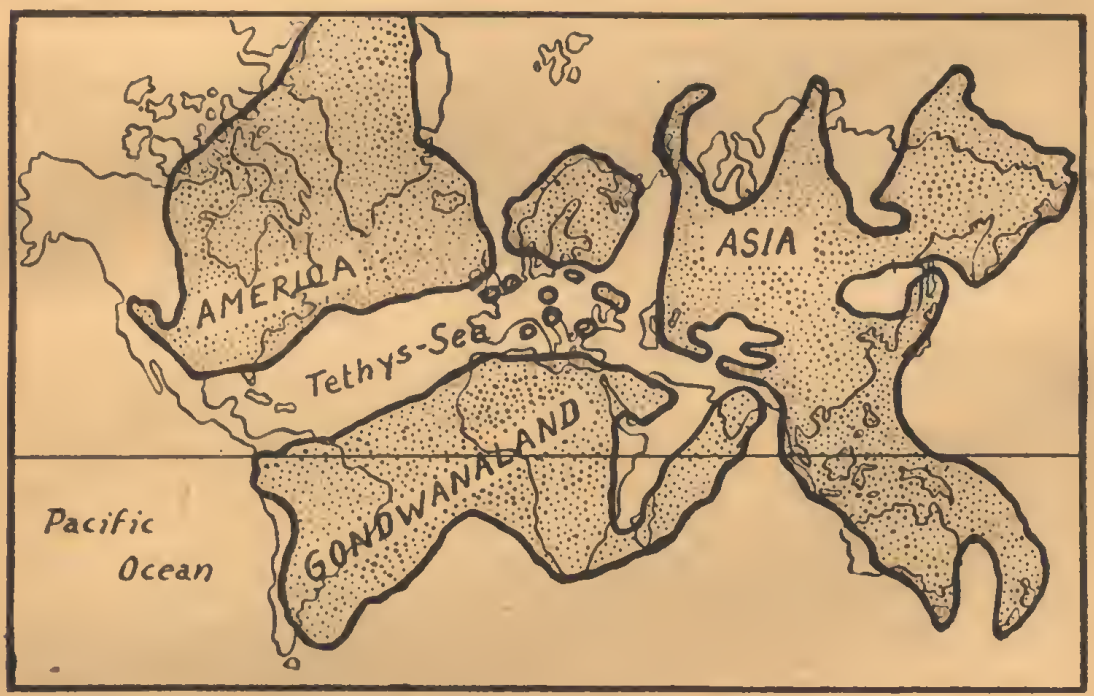
that it grew onto America via the Bering Sea.

BUT, before we discuss the face of the Earth during that most important period, we have to return to the Devonian Period again for a little while. During that so successful American "expansion" that had even blocked the Tethys Sea for a short while in attaching America's southern "tail" to Gondwanaland's northwest two things had happened. One was conspicuous but superficial. Eroding Silurian mountains had formed those endless red deserts that are preserved as "old red sandstone" and that made Earth look even redder than Mars.

That red color, however, conspicuous as it must have been if viewed from cosmic distances, was not the most important change. Something of much more far-reaching consequences had happened during the Devonian Period.

Our space-time travelers were probably only a few million years too early. Only a little later—as such words are used by geologists—they could have witnessed how life conquered the land. In New York, near Gilboa, N. Y., grew the true forest primeval, the oldest forest known. There was a large river, forming a swampy delta on the site of the Catskill Mountains and it is from this delta of the Middle Devonian that the oldest known fossil tree trunks come. They belong to fernlike trees, not true ferns. Of animal life there were giant scorpionlike things, probably the ancestors of scorpions, spiders and insects and also some very primitive amphibia, still close to the fishes that dared for the first time to venture out of the water into the open air.

In Nature as well as in human arts it may take a long time until something new is started and on the way. But then it develops with amazing rapidity. Only one geologic period later that first forest primeval had spread to every region where there was room and rain and there was very much room and plenty of rain. The immense swamps



Upper Jurassic Period, about one hundred and thirty million years ago. End of Gondwanaland, the present map begins to shape up.

Early Tertiary Period, about fifty million years ago. Today's map is about ready, but more water than ever.

of the Carboniferous Period had come into existence. Those lungfishlike creatures had developed into *Archegosaurus,* a crocodile-sized amphibian. Even aëronautics had been mastered, dragonflylike insects zoomed through the forests, measuring from wing tip to wing tip between twenty-five and thirty inches! Earth had at last become a green world and although there were no flowers yet and no animal life that could be called pleasant, it was at least a habitable world.

The map of the Earth showed a very definite tendency, a tendency that had made itself felt all through the preceding changes. It was the tendency to develop a northern counterpart of Gondwanaland. The real Gondwanaland in the south always gives the impression that it strove to circle the planet. It did not succeed because it could never conquer the vast expanse of the Pacific Ocean that should be named the Permanent Ocean. But as far as Gondwanaland succeeded it was at least solid land. In the north things were different. There was more land and the small extension of the Pacific Ocean that we now know as Bering Sea was by no means unconquerable. In fact it has become dry land repeatedly in geologic history. Still the northern continents did not manage to grow together. America had grown all across the North Atlantic Ocean and reached Europe in the east. In the west it had eliminated what Pacific waters were in the way and formed a solid connection with Asia. But the northern continents did not succeed in forming an unbroken ring. The Tethys Sea always forced its way through to the Arctic Ocean, sometimes in blotting out Europe, sometimes, when Europe was strengthened by attachment to America, in forcing its way through Russia along a line running roughly parallel to the Ural Mountains of today. The location of the trough that opened there and soon developed into a wide sea coincides fairly well with that of the present river Ob and is therefore oftentimes called the "Obian Trough" or the Obian Sea.

Will the map look like this a million years hence? If our predictions are correct, we might again expect a greater water area and the continents would break up into large archipelagos.

While the Tethys Sea thus prevented the northern continents from uniting, the Arctic Ocean undertook another attack of its own. It almost succeeded in separating America proper from its Greenlandic-Icelandic-European "possessions." It almost succeeded but not quite. And the whole "Davis Sea" as it has been called, did not last long. It is evident that the present mountains did not exist at that time, else the attacks of the sea would have succeeded in different places. We know as a matter of fact that the Rocky Mountains as well as the Andes, the Alps as well as the Himalayas are of a much more recent date; they were not even dreamed of then.

Which does not mean that there were no mountains during the Carboniferous Period. There were and many more were being formed just then. One titanic mountain chain was running from Vienna to Paris; it has been called "Variskian Mountains" and some of the present mountainous areas of Central Europe still contain ruins of those "Carboniferous Alps," for example the Hartz Mountains and the Black Forest. Still much larger than the Variskian Mountains were the Armoricanian Mountains, running from France all the way to America and ending probably in the region of the Alleghenys that were then already in existence for some time. The Ural Mountains began to form, in spite of the water of the Obian Sea, soon after they served to reunite Europe and Asia. Many smaller mountain chains came into existence in America, in Asia and in all probabilities in Gondwanaland, too.

It is the erosion of these mountains that has been blamed with ruining the climate of the Carboniferous Period. The following period, the Permian, brought the first Ice Age of which we have definite knowledge. Wherever the land was sufficiently far away from the Equator or considerably above sea level, even near the Equator, glaciers began to form. Even Gondwanaland got its

cold wave. But while the erosion of the mountains disturbed the climate—and the disturbed climate produced the first mammals in Gondwanaland—the continents grew and grew.

THUS another typical picture was in preparation, a picture that became very clear one world-age later, during the Triassic Period. The map of that period looks as if the continents were determined to eliminate the seas on the land hemisphere altogether. Only the Pacific Ocean held its ground. Gondwanaland, while extending only slightly farther to the west than South America does today, had gained tremendously in north-southernly direction. Its west coast pushed south even farther than Tierra del Fuego, the African sector extended south far beyond the Cape of Good Hope and the Australian sector beyond Tasmania. America and Asia, larger and mightier than ever before, approached the ideal of a northern continental ring.

Only two gaps were left, one in Central Europe that had again become a swarm of islands because the Obian Sea had closed, and the waters of the Tethys had lost that "safety valve." But the two large northern continents still almost touched, a narrow sound of not much more than a hundred miles in width was all that the Tethys could accomplish. Another somewhat wider gap had formed through East Siberia; "Lena Trough" would be an appropriate name for it. The most surprising thing was that the Tethys itself was menaced in its eastern parts, it seems that there actually existed land connections between Gondwanaland and Asia for short periods of time.

During Triassic times there were again periods where Earth was dotted with red deserts, but they were not without life any more. Tracks preserved in sandstone tell us about the mysterious *Chirotherium,* an animal—probably reptile—with paws looking exactly like human hands. These tracks—and there is an abundance of them—is all we know, nobody ever found fossilized bones of that strange creature of the red deserts. The climate must have been fairly dry, slowly getting warmer and warmer until that moist warmth was attained that seems to be "normal" for our planet. That was in the beginning of the Jurassic Period and then the great change came. The sea achieved triumphal victories everywhere. The Bering Sea came into being again, America shrunk, the European archipelago grew in area—also a victory of the sea—Scandinavia, that had been attached to Asia, was torn away. Asia itself suffered defeats all around its coast.

And Gondwanaland was destroyed!

The Indian Ocean came into existence, separating the Malayo-Australian parts from the remainder of Gondwanaland. For some time Australia was connected with Asia in the north, but not for long. Soon it was completely isolated; we owe the preservation of its interesting marsupial fauna to this fact.

The breakdown of the old colossal continents had generally beneficial results. The prevailing winds on Earth follow the direction of the Equator. Continents that extended endlessly in east-westernly direction could not get much rain. The north-south orientation is more "desirable." It was finally attained during the Jurassic Period; there existed now less land than before, but more fertile land. Almost everything in the world was badly shaken up. New Zealand began to separate from Australia, the "living fossil" *Tuatera* or *Hatteria* was trapped and preserved there. Madagascar still maintained a narrow connection with Africa on the one and India on the other side, so it seems likely that the ancestors of the peacocks wandered across this bridge either from Africa to India or vice versa.

When that connection broke they split into the two now existing groups, the well-known ornamental peacocks of Asia and the less spectacular but more ancestral African group of which *Afropavo congensis* is the last survivor that was discovered only recently.

THE ONLY remaining solid block of Gondwanaland, South America and Africa, did not last beyond the Jurassic Period either. The process of destruction of the ancient continents that had started during that period came to a climax during the following Cretaceous Period. It is only slightly exaggerated, if at all, to say that at the height of the Cretaceous Period—which at the same time set an all-time high for animal life on Earth—there were hardly any continents left. The maps consisted of archipelagos of larger and smaller islands, of extended peninsulas that looked flimsy enough, or broken-up shore lines. Water, water, water everywhere and in every form. Oceans, shallow bays, lagoons, large fresh-water lakes, immense rivers with the necessary capacity to manage the amount of rainfall. Looking back to the Triassic map one wonders where all that water came from, and it is only slightly surprising that somebody advanced the theory of a continued bombardment with ice meteorites during that time.

Near the end of the Cretaceous Period things began to stabilize somewhat. The map that literally emerged from the waters looks much like our own. Gondwanaland has disappeared completely. Europe is again attached to America and separated from Asia. The Tethys Sea still exists, somewhat disguised. But it needs only a little more land here and a little less land there to result in the picture that mankind had to "dis-

cover" in centuries of exploration, sailing seas that were but small remainders of former glories and climbing mountains that looked as solid as eternity while actually their age had barely approached a score of million years.

IT PAYS to look at the world's map of today for signs of future developments. We have pretty solid continents at present, but just because they are we may suspect a tendency for another breakdown. This suspicion grows even stronger if we remember that the periods with much land and with solid continents were always those with a cool below normal climate as we are having, but not enjoying, now. The "paradisic" periods, on the other hand, were those where an admiralty chart was more useful than a map. Since I am convinced that our climate is trying to get back to normal, I also expect an increase in water surface on our globe.

Such an increase does not require additional water. If all the land that is above sea level at present were ground up and dumped into the deeper portions of the oceans and if all the ice on Earth were melted, we would really see a panthalassa, almost seven thousand feet deep all around. Which proves that there is water enough to form troughs splitting up the continents and transforming them into islands and archipelagos. It is also safe to predict that the general direction of these "troughs" would be from north to south. In addition to all these general conclusions there are actually places that look as if they might be flooded one day.

North America's Mississippi Valley is a place that might again turn to sea bottom as it did so often before. I also do not place too much faith in the stability of Panama. East Siberia looks suspicious along a line starting out from Kamtchatka Bay and later roughly following the River Lena. Of course the Valley of the Ob, east of the Ural Mountains, cannot be trusted. Africa shows a similar vertical line in the east, following the line of its large lakes and later that of the Nile Valley. And, if things really got moving in such a way, the whole northwest of Africa would disappear save for a few islands, and Europe would again be an archipelago with not many boundary lines to fight over.

What Time Travelers really need is a large and detailed map of the world. A map that does not only show all the elevations of land as completely as possible but also their geologic age. And even then it would be strongly advisable not to rest the time machine on solid-looking ground but to install it on board an Ark that is permanently waterproof and equipped with a high-powered and reliable Diesel engine.

In the August ASTOUNDING—Willy Ley discusses "Space War" and suggests as the deadliest weapon in space, one seldom mentioned in fiction!

GREATER THAN GODS

By C. L. MOORE

GREATER THAN GODS

If a man could see the end of his act, the end that comes at the far end of Time, and know what it meant—would men be greater than gods?

By C. L. Moore

Illustrated by Schneeman

THE desk was glass-clear steel, the mirror above it a window that opened upon distance and sight and sound whenever the televisor buzzer rang. The two crystal cubes on the desk were three-dimensional photographs of a sort undreamed of before the Twenty-third Century dawned. But between them on the desk lay a letter whose message was older than the history of writing itself.

"My darling—" it began in a man's strongly slanting handwriting. But there Bill Cory had laid down his pen and run despairing fingers through his hair, looking from one crystal-cubed photograph to the other and swearing a little under his breath. It was fine stuff, he told himself savagely, when a man couldn't even make up his mind which of two girls he wanted to marry. Biology House of Science City, that trusted so faithfully the keenness and clarity of Dr. William Cory's decisions, would have shuddered to see him now.

For the hundredth time that afternoon he looked from one girl's face to the other, smiling at him from the crystal cubes, and chewed his lip unhappily. On his left, in the translucent block that had captured an immortal moment when dark Marta Mayhew smiled, the three-dimensional picture looked out at him with a flash of violet eyes. Dr. Marta Mayhew of Chemistry House, ivory whiteness and satin blackness. Not at all the sort of picture the mind conjures up of a leading chemist in Science City which houses the greatest scientists in the world.

Bill Cory wrinkled his forehead and looked at the other girl. Sallie Carlisle dimpled at him out of the crystal, as real as life itself to the last flying tendril of fair curls that seemed to float on a breeze frozen eternally into glass. Bill reached out to turn the cube a little, bringing the delicate line of her profile into view, and it was as if time stood still in the crystalline deeps and pretty Sallie in the breathing flesh paused for an eternal moment with her profile turned away.

After a long moment Bill Cory sighed and picked up his pen. After the *"Darling"* of the letter he wrote firmly, *"Sallie."*

"Dr. Cory," hesitated a voice at the door. Bill looked up, frowning. Miss Brown blinked at him nervously behind her glasses. "Dr. Ashley's—"

"Don't announce me, Brownie," interrupted a languid voice behind her. "I want to catch him loafing. Ah, Bill, writing love letters? May I come in?"

"Could I stop you?" Bill's grin erased the frown from his forehead. The tall and tousled young man in the doorway was Charles Ashley, head of Telepathy House, and though their ac-

quaintance had long been on terms of good-natured insult, behind it lay Bill's deep recognition of a quality of genius in Ashley that few men ever attain. No one could have risen to the leadership of Telepathy House whose mind did not encompass many more levels of infinite understanding than the ordinary mind even recognizes.

"I've worked myself into a stupor," announced the head of Telepathy House, yawning. "Come on up to the Gardens for a swim, huh?"

"Can't." Bill laid down his pen. "I've got to see the pups—"

"Damn the pups! You think Science City quivers every time those little mutts yap! Let Miss Brown look after 'em. She knows more than you do about genetics, anyhow. Some day the Council's going to find it out and you'll go back to working for a living."

"Shut up," requested Bill with a grin. "How are the pups, Miss Brown?"

"Perfectly normal, doctor. I just gave them their three o'clock feeding and they're asleep now."

"Do they seem happy?" inquired Ashley solicitously.

"That's right, scoff," sighed Bill. "Those pups and I will go ringing down the corridors of time, you mark my words."

ASHLEY NODDED, half seriously. He knew it might well be true. The pups were the living proof of Bill's success in prenatal sex determination—six litters of squirming maleness with no female among them. They represented the fruit of long, painstaking experiments in the X-ray bombardment of chromosomes to separate and identify the genes carrying the factors of sex determination, of countless failures and immeasurable patience. If the pups grew into normal dogs—well, it would be one long, sure stride nearer the day when, through Bill's own handiwork, the world would be perfectly balanced between male and female in exact proportion to the changing need.

Miss Brown vanished with a shy, self-effacing smile. As the door closed behind her, Ashley, who had been regarding the two photograph cubes on Bill's desk with a lifted eyebrow, arranged his long length on the couch against the wall and was heard to murmur: "Eenie meenie minie mo. Which is it going to be, Will-yum?"

They were on terms too intimate for Bill to misunderstand, or pretend to.

"I don't know," he admitted miserably, glancing down in some hesitation at the letter beginning, *"My darling Sallie—"*

Ashley yawned again and fumbled for a cigarette. "You know," he murmured comfortably, "it's interesting to speculate on your possible futures. With Marta or Sallie, I mean. Maybe some day somebody will find a way to look ahead down the branching paths of the future and deliberately select the turning points that will carry him toward the goal he chooses. Now if you could know beforehand where life with Sallie would lead, or life with Marta, you might alter the whole course of human history. That is, if you're half as important as you think you are."

"Huh-uh," grunted Bill. "If you predicate a fixed future, then it's fixed already, isn't it? And you'd have no real choice."

Ashley scratched a match deliberately and set his cigarette aglow before he said: "I think of the future as an infinite reservoir of an infinite number of futures, each of them fixed, yet malleable as clay. Do you see what I mean? At every point along our way we confront crossroads at which we make choices among the many possible things we may do the next moment. Each crossroad leads to a different future, all of them possible, all of them fixed, waiting for our choice to give them reality. Perhaps there's a—call it

a Plane of Probability—where all these possible results of our possible choices exist simultaneously. Blueprints of things to come. When the physical time of matter catches up with, and fills in, any one particular plan, it becomes fixed in the present.

"But before time has caught up with it, while our choice at the crossroads is still unmade, an infinite number of possible futures must exist as it were in suspension, waiting for us in some unimaginable, dimensionless infinity. Can you imagine what it would be like to open a window upon that Probability Plane, look out into the infinities of the future, trace the consequences of future actions *before* we make them? We could mold the destiny of mankind! We could do what the gods must do, Bill! We'd be greater than gods! We could look into the Cosmic Mind—the very brain that planned us—and of our own will choose among those plans!"

"Wake up, Ash," said Bill softly.

"You think I'm dreaming? It's not a new idea, really. The old philosopher, Berkeley, had a glimpse of it when he taught his theories of subjective idealism, that we're aware of the cosmos only through a greater Awareness all around us, an infinite mind—

"Listen, Bill. If you vision these . . . these blueprints of possible futures, you've got to picture countless generations, finite as ourselves, existing simultaneously and completely in all the circumstances of their entire lives—yet all of them still unborn, still even uncertain of birth if the course of the present is diverted from their particular path. To themselves, they must seem as real as we to each other.

"Somewhere on the Plane of Probability, Bill, there may be two diverging lines of your descendants, unborn generations whose very existence hinges on your choice here at the crossroads. Projections of yourself, really, their lives and deaths trembling in the balance. Think well before you choose!"

Bill grinned. "Suppose you go back to the Slum and dope out a way for me to look into the Cosmic Plan," he suggested.

Ashley shook his head.

"Wish I could. Boy, would you eat that word 'Slum' then! Telepathy House wouldn't be the orphan child around the City any longer if I could really open a window onto the Probability Plane. But I wouldn't bother with you and your pint-sized problems. I'd look ahead into the future of the City. It's the heart of the world, now. Some day it may rule the world. And we're biased, you know. We can't help being. With all the sciences housed here under one city-wide roof, wielding powers that kings never dreamed of—No, it may go to our heads. We may overbalance into . . . into . . . well, I'd like to look ahead and prevent it. And if this be treason—" He shrugged and got up. "Sure you won't join me?"

"Go on—get out. I'm a busy man."

"So I see." Ashley twitched an eyebrow at the two crystal cubes. "Maybe it's good you can't look ahead. The responsibility of choosing might be heavier than you could bear. After all, we aren't gods and it must be dangerous to usurp a god's prerogative. Well, see you later."

BILL LEANED in the doorway watching the lounging figure down the hall toward the landing platform where crystal cars waited to go flashing along the great tubes which artery Science City. Beyond, at the platform's edge, the great central plaza of the City dropped away in a breath-taking void a hundred stories deep. He stood looking out blind-eyed, wondering if Sallie or Marta would walk this hall in years to come.

Life would be more truly companionship with Marta, perhaps. But did a family need two scientists? A man

wanted relaxation at home, and who could make life gayer than pretty Sallie with her genius for entertainment, her bubbling laughter? Yes, let it be Sallie. If there were indeed a Probability Plane where other possible futures hung suspended, halfway between waking and oblivion, let them wink out into nothingness.

He shut the door with a little slam to wake himself out of the dream, greeting the crystal-shrined girl on his desk with a smile. She was so real—the breeze blowing those curls was a breeze in motion. The lashes should flutter against the soft fullness of her lids—

Bill squeezed his eyes shut and shook his head to clear it. There was something wrong—the crystal was clouding—

A ringing in his ears grew louder in company with that curious blurring of vision. From infinitely far away, yet strangely in his own ears, a tiny voice came crying. A child's voice calling, "Daddy. . . . daddy!" A girl's voice, coming nearer, "Father—" A woman's voice saying over and over in a smooth, sweet monotone, "Dr. Cory. . . . Dr. William Cory—"

Upon the darkness behind his closed lids a streaked and shifting light moved blurrily. He thought he saw towers in the sun, forests, robed people walking leisurely—and it all seemed to rush away from his closed eyes so bewilderingly—he lifted his lids to stare at—

To stare at the cube where Sallie smiled. Only this was not Sallie. He gaped with the blankness of a man confronting impossibilities. It was not wholly Sallie now, but there was a look of Sallie upon the lovely, sun-touched features in the cube. All of her sweetness and softness, but with it—something more. Something familiar. What upon this living, lovely face, with its level brown eyes and courageous mouth, reminded Bill of—himself?

His hands began to shake a little. He thrust them into his pockets and sat down without once taking his eyes from the living stare in the cube. There was amazement in that other stare, too, and a half-incredulous delight that brightened as he gazed.

Then the sweet curved lips moved—lips with the softness of Sallie's closing on the firm, strong line of Bill's. They said distinctly, in a sound that might have come from the cube itself or from somewhere deep within his own brain: "Dr. Cory . . . Dr. Cory, do you hear me?"

"I hear you," he heard himself saying hoarsely, like a man talking in a dream. "But—"

The face that was Sallie's and his blended blazed into joyful recognition, dimples denting the smooth cheeks with delicious mirth. "Oh, thank Heaven it *is* you! I've reached through at last. I've tried so hard, so long—"

"But who . . . what—" Bill choked a little on his own amazement and fell silent, marveling at the strange warm tenderness that was flooding up in him as he watched this familiar face he had never seen before. A tenderness more melting and protective and passionately selfless than he had ever imagined a man could feel. Dizzy with complete bewilderment, too confused to wonder if he dreamed, he tried again. "Who are you? What are you doing here? How did—"

"But I'm not there—not really." The sweet face smiled again, and Bill's heart swelled until his throat almost closed with a warmth of pride and tenderness he was too dizzy to analyze now. "I'm here—here at home in Eden, talking to you across the millennium! Look—"

SOMEHOW, until then he had not seen beyond her. Sallie's face had smiled out of a mist of tulle, beyond which the cube had been crystal-clear. But behind the face which was no longer wholly Sallie's, a green hillside filled the

cube. And, very strangely, it had no look of smallness. Though the cube's dimensions confined it, here was no miniature scene he gazed upon. He looked through the cube as through a window, out into a forest glade where upon a bank of green myrtle at the foot of a white garden wall a little group of tanned men and women reclined in a circle with closed eyes, lying almost like corpses on the dark, glossy leaves. But there was no relaxation in them. Tensity more of the spirit than the body knit the group into a whole, focused somehow upon the woman in the circle's center—this fair-haired woman who leaned forward with her elbows on her knees, chin in hand, staring brown-eyed and tensely into space—into Bill Cory's eyes. Dimly he realized that his perception had expanded as he stared. Awareness now of a whole countryside beyond her, just over the garden wall, made this cube that had housed Sallie's careless smile a window indeed, opening upon distance in space and time far outside his imagining.

He knew he was dreaming. He was sure of it, though the memory of what Ashley had been saying hovered uneasily in the back of his mind, too elusive now to be brought consciously into view. But in this impossible dream he clenched his hands hard in his pockets, taking a firm hold upon reality.

"Just who are you, and what do you want? And how did you—"

She chose to answer the last question first, breaking into it as if she could read his thoughts as she knelt staring on the myrtle leaves.

"I speak to you along an unbroken cord between us—father. Thousands of times removed, but—father. A cord that runs back through the lives that have parted us, yet which unite us. With the help of these people around me, their full mental strength supplementing mine, we've established contact at last, after so many failures, so much groping in mysteries which even I understand only partly, though my family for generations has been trained in the secrets of heredity and telepathy."

"But why—"

"Isn't the fact of achievement an end in itself? Success in establishing a two-way contact with the past, in talking to one's own ancestors—do I need more reason for attempting that than the pure joy of achieving it? You wonder why you were chosen. Is that it? Because you are the last man in a direct line of males to be born into my family before the blessed accident that saved the world from itself.

"Don't look so bewildered!" Laughter bubbled from the cube—or was it a sound in his own brain? "You aren't dreaming! Is it so incredible that along the unbroken cord of memories which links your mind to mine the current might run backward against the time flow?"

"But who are you? Your face—it's like—"

"My face is the face of the daughter that Sallie Cory bore you, thousands of years ago. That resemblance is a miracle and a mystery beyond all understanding—the mystery of heredity which is a stranger thing than the fact of our communication. We have wondered among ourselves if immortality itself—but no, I'll have mercy on you!"

This bewilderingly beloved face that had darkened with mystical brooding, flashed suddenly alive again with swift laughter, and hearing it, catching a lift of the brows that was his and a quirk of the soft lips that was Sallie's own, Bill made no effort to stem the tide of warm affection rising higher and higher in him. It was himself looking out of this cube through Sallie's brown eyes—himself exultant in achievement for the simple sake of achieving. She had called him father. Was this a father's love, selfless, unfathomable, for a lovely and beloved daughter?

"Don't wonder any more," laughed the voice in his ears. "Look—here's the past that lies between us. I want you to understand what parts your world from mine."

SOFTLY the myrtle glade and the lovely smiling face that blended Sallie and Bill melted into the depths of a cloud forming inside the three dimensions of the cube. For a moment—nothing. Then motion was lifting behind the mist, shouldering the veils aside. Three-dimensional space seemed to open up all around him—

He saw a wedding procession coming down a church aisle toward him, Sallie smiling mistily through a cloud of silver tulle. And he knew at the sight of her that though it was only chance which had chosen her instead of dark Marta Mayhew, he could come to love Sallie Carlisle Cory with an intensity almost frightening.

He saw time go by with a swiftness like thought itself, events telescoping together with no sense of confusion, moving like memories through his mind, clear, yet condensed into split seconds. He was watching his own future, seeing a life that revolved around Sallie as the center of existence. He saw her flashing in and out of his laboratory as he worked, and whenever she entered, the whole room seemed to light up; whenever she left, he could scarcely work for the longing to follow.

He saw their first quarrel. Sallie, spinning in a shimmer of bright glass-silk as soft as gossamer, dimpled at the self which in this waking dream was more vividly Bill Cory than the Bill who watched. "See, darling, aren't I heavenly?" And he heard himself answering, "Edible, darling! But isn't that stuff expensive?"

Sallie's laughter was light. "Only fifteen hundred credits. That's dirt-cheap for a Skiparelle model."

He gasped. "Why Sallie, that's more than we're allowed for living expenses! I can't—"

"Oh, daddy'll pay for it if you're going to be stingy. I only wanted—"

"I'll buy my wife's clothes." Bill was grim. "But I can't afford Paris fashions, darling."

Sallie's pretty underlip pouted alarmingly. Tears sparkled in the soft brown eyes she lifted to his, and his heart melted almost painfully in one hopeless rush.

"Don't cry, sweetheart! You can keep it, just this once. But we'll have to make it up next month. Never again, Sallie, understand?"

Her nod was bright and oblivious as a child's.

But they didn't make it up. Sallie loved partying, and Bill loved Sallie, and nowadays there was much more hilarity than work going on behind the door in Biology House marked "Dr. William Vincent Cory." The television's panels were tuned to orchestras playing strong rhythm now, not to lectures and laboratory demonstrations as of old.

No man can do two jobs well. The work on sex determination began to strike snags in the path that had seemed almost clear to success, and Bill had so little time any more to smooth them out. Always Sallie was in the back of his mind, sweet, smiling, adorable.

Sallie wanted the baby to be born in her father's home. It was a lovely place, white-walled on low green hills above the Pacific. Sallie loved it. Even when little Sue was big enough to travel she hated to think of leaving. And the climate was so wonderful for the baby there—

Anyhow, by then the Council had begun to frown over Bill Cory's work. After all, perhaps he wasn't really cut out to be a scientist—Sallie's happiness was more important than any man's job, and Sallie could never be really happy in Science City.

The second baby was a girl, too.

There were a lot of girls being born nowadays. The telenews broadcasters joked about it. A good sign, they said. When a preponderance of boys was born, it had always meant war. Girls should bring peace and plenty for the new generation.

Peace and plenty—that was what mattered most to Bill and Sallie Cory now. That and their two exquisite daughters and their home on the green Pacific hills. Young Susan was growing up into a girlhood so enchanting that Bill suffused with pride and tenderness every time he thought of her. She had Sallie's beauty and blondeness, but there was a resolution in her that had been Bill's once, long ago. He liked to think of her, in daydreams, carrying on the work that he would never finish now.

Time ran on, years telescoping pleasantly into uneventful years. Presently the Cory girls were growing up . . . were married . . . were mothers. The grandchildren were girls, too. When Grandfather Cory joined his wife in the little graveyard on the sea-turned hill beyond the house, the Cory name died with him, though there was in his daughter's level eyes and in her daughter's look of serene resolution something more intrinsically Bill Cory than his name. The name might die, but something of the man who had borne it lived on in his descendants.

GIRLS CONTINUED to outnumber boys in the birth records as the generations passed. It was happening all over the world, for no reason that anyone could understand. It didn't matter much, really. Women in public offices were proving very efficient; certainly they governed more peacefully than men. The first woman president won her office on a platform that promised no war so long as a woman dwelt in the White House.

Of course, some things suffered under the matriarchy. Women as a sex are not scientists, not inventors, not mechanics or engineers or architects. There were men enough to keep these essentially masculine arts alive—that is, as much of them as the new world needed. There were many changes. Science City, for instance. Important, of course, but not to the extent of draining the country dry to maintain it. Life went on very nicely without too much machinery.

The tendency was away from centralized living in these new days. Cities spread out instead of up. Skyscrapers were hopelessly old-fashioned. Now parklands and gardens stretched between low-roofed houses where the children played all day. And war was a barbarous memory from those nightmare years when men still ruled the world.

Old Dr. Phillips, head of the dwindling and outmoded Science City, provoked President Wiliston into a really inspiring fury when he criticized the modern tendency toward a non-mechanized rural civilization. It happened on the telenews, so that half the world heard it.

"But Madam President," he said, "don't you realize where we're heading? The world's going backward! It's no longer worth while for our best minds to attempt bettering living conditions. We're throwing genius away! Do you realize that your cabinet yesterday flatly rejected the brilliant work of one of our most promising young men?"

"I do!" Alice Wiliston's voice rang with sudden violence over half the world. "That 'brilliant work,' as you call it, was a device that might have led to war! Do you think we want that? Remember the promise that the first woman president made the world, Dr. Phillips! So long as we sit in the White House there will be no need for war!"

And Elizabeth of England nodded in London; Julianna VII smiled into her Amsterdam telenews screen. While women ruled, war was outlawed. Peace

and ease and plenty would dominate civilization, leisure for cultivation of the arts, humankind coming into its own at last, after so many ages of pain and blood and heartbreak.

Years telescoped into centuries of peace and plenty in a garden world. Science had turned its genius to the stabilization of the climate so that nowhere was shelter necessary from cold or storms; food was freely abundant for all. The Garden that Adam and Eve forfeited in the world's beginning had returned again to their remotest descendants, and the whole earth was Eden.

And in this world that no longer demanded the slightest physical effort, mankind was turning to the cultivation of the mind. In these white, low-roofed houses set among garden parks, men and women increasingly adventured into the realms beyond the flesh, exploring the mysteries of the mind.

Bill Cory, leaning forward in his chair, had lost all identity with himself. He was simply a consciousness watching time unfold before him. The gravestone that bore his name on the California hillside had long since sunk into the sod, but if there is immortality at all, Bill Cory watched himself move forward through the centuries, down the long, expanding line of his descendants. Now and again, startlingly, his own face looked briefly at him from some far-away child of his remote grandchildren. His face, and Sallie's.

He saw pretty Sue come and go like reflections in a mirror. Not always Sue unmistakably and completely—sometimes only her brown eyes lighted the face of a many-times-great-granddaughter; sometimes the lift of her smile or the tilt of her pretty nose alone was familiar to him in a strange face. But sometimes Sue herself, perfect to the last detail, moved through the remote future. And every time he saw those familiar features, his heart contracted with an ache of tenderness for the daughter he yet might never have.

It was for these beloved Susans that he was becoming uneasy as he watched time go by in this lazy paradise world. People were slowing mentally and physically. What need any more for haste or trouble? Why worry because certain unimportant knowledge was being lost as time went on? The weather machines, the food machines were eternal; what else really mattered? Let the birth rate decline, let the dwindling race of the inventive and the ambitious fade like the anachronism it was. The body had taken mankind as far as it could; the mind was the vehicle for the future. In the vast reaches of infinity were fields aplenty for the adventurous spirit. Or one could simply drowse the days away—

CLOUDS thickened softly across the dreamy vistas of Eden. Bill Cory leaned back in his chair and rubbed his eyes with both hands. The hands were shaking, and he stared at them a little stupidly, still half lost in the wonder of what he had seen, in the strange welter of emotions that still warred in him—the memory of Sallie and his strong love for her, the memory of Sue's sweetness, the memory of pride in them both. And in the queer feeling that it had been himself in those many daughters of his through the ages, striving so hard for world peace to the ultimate end that mankind might achieve—*ruin*.

For it was wrong—it was bad. The whole world. The race of man was too splendid, too capable of working miracles, to end on a myrtle bank dreaming about abstractions. He had just seen a decadent, indolent, civilization going down the last incline into oblivion as a result—yes, as a direct result—of his own action. He'd seen himself sinking into a fat, idle old age, without honor of achievement.

Suddenly and desperately he hoped

that Ashley had been right—that this was not the inevitable and changeless future. If he tore up the letter lying on his desk now, if he never married Sallie, would not his work be finished successfully some day, and the catastrophe of unbalanced births avoided? Or could a man change his ordained future?

Almost fearfully he reached for the letter lying beside that clouded cube in which the years had mirrored themselves. Would he be able to take the letter up and rip it across—like this? The sound of tearing paper reassured him. So far, at least, he was still a free agent.

And knowing that, suddenly he was sorry. Not to marry Sallie, with her bubbling laugh. Never to see young Sue growing into beauty and courage and sweetness. Old age without achievement, had he said to himself a moment ago? Sue herself was achievement enough for any man. Sue and those other Susans down the long line of his descendants, incarnating again and again all that was finest in him, eternal as life itself through millenniums.

He did not want to meet again the brown eyes of this latest Susan who had come to him in the depths of the cube. While he looked, his reason was lost in his love for her, and not even against reason could he believe the world which had produced her to be anything but perfect, simply because this beloved daughter moved and breathed in it.

But the letter was torn. He would never marry Sallie if he could help himself. The cost was too high, even for such a reward as Sue. And an almost tremulous awe broke over him in a sudden tide as he realized what he was doing. This was what Ashley had dreamed of—opening a window into the Plane of Probability and learning enough to force the Cosmic Mind out of its course. Changing the shape of his own future and that of all mankind. Greater than gods—but he was no god. And Ashley had warned him that it might be dangerous to usurp a god's prerogative. Suddenly he was afraid.

He looked away from that cube which held his future, and across from it on his desk the violet eyes of Marta Mayhew caught his, fixed in their changeless smile. She was a girl, he thought, he remembered from half a lifetime ago, so much had happened since he glanced last into her face. Dark and lovely she was, her eyes meeting his almost as if there were vision behind their deep, long stare. Almost as if—

LIGHT FLARED out in one white, blinding sheet that blotted out the cube and the violet-eyed face and the room around him. Involuntarily Bill clapped his hands to his eyes, seeing behind the darkness of his lids a dazzle of blurring colors. It had happened too quickly for wonder—he was not even thinking as he opened his eyes and looked into the cube where Marta's gaze had met him a moment before.

And then a great tide of awe and wonder came washing up into his consciousness, and he knew that Ashley had been right. There was an alternative future. There comes a point beyond which bewilderment and shock no longer affect the human brain, and Bill was outside wondering now, or groping for logical explanations. He only knew that he stood here staring into the cube from which Marta's eyes had smiled at him so short an instant ago—

They were still Marta's eyes, deep-colored in a boy face almost Bill's own, feature for feature, under a cap of blue steel. Somehow that other future had come to him, too. He was aware of a sudden urgent wonder *why* they had come so nearly together, though neither could be conscious of the other— But things were moving in the depths of the cube.

Behind the boy's face, three-dimensional perspective had started vividly back from the crystal surfaces, as if the cube were a wide window flung suddenly open upon a new world. In that world, a place of glass and shining chromium, faces crowded as if indeed at an open window, peering into his room. Steel-helmed faces with staring eyes. And foremost among them, leaning almost through the opened window into his own past, the steel-capped boy whose features were Bill's looked eagerly out, the sound of quickened breath through his lips a soft, clear sound in the room. They were Bill's lips, Bill's features—but Marta's gentle courage had somehow grown masculine in the lines of the boy's face, and her eyes met Bill's in his.

In the instant before those parted lips spoke, Bill knew him, and his throat closed on an unuttered cry of recognition—recognition of this face he had never seen before, yet could not mistake. The deep welling of love and pride in his heart would have told him the boy's identity, he thought, had he not known at sight who he was—would be—might one day be—

He heard his own voice saying doubtfully, "Son—?"

But if the boy heard he must not have understood. He was handicapped by no such emotion as stirred Bill. His clipped, metallic voice spoke as clearly as if indeed through an opened window: "Greetings from the United World, William Vincent Cory! Greetings from the Fifteenth Leader in the Fifth New Century, A. G."

Behind the disciplined, stern-featured young face others crowded, men with steel-hard features under steel caps. As the boy's voice paused, a dozen right arms slanted high, a dozen open palms turned forward in a salute that was old when Caesar took it in ancient Rome. A dozen voices rolled out in clipped accents, "Greetings, William Vincent Cory!"

Bill's bewildered stammer was incoherent, and the boy's face relaxed a little into a smile. He said: "We must explain, of course. For generations our scientists have been groping in the past, Dr. Cory. This is our first successful two-way contact, and for its demonstration to our Council, connection with you were selected as the most appropriate and fitting contact possible. Because your name is holy among us; we know all there is to know of your life and work, but we have wished to look upon your face and speak to you of our gratitude for molding mankind into the patterns of the United World.

"As a matter of record, I have been instructed to ask first at what point we have intersected the past. What date is it in your calendar?"

"Why, it's July 7, 2240," Bill heard his own voice stammer a little as he answered, and he was conscious of a broad and rather foolish grin overspreading his face. He couldn't help it. This was his boy—the child who wouldn't be born for years yet, who might, really, never be born. Yet he knew him, and he couldn't help smiling with pride, and warm, delighted amusement. So stern-faced, so conscious of his own responsibility! Marta's son and his—only of course it couldn't be, exactly. This scene he looked into must be far ahead in time—

"Twenty-two forty!" exclaimed the boy who was not his son. "Why, the Great Work isn't even finished yet then! We're earlier than we knew!"

"Who are you, son?" Bill couldn't keep the question back any longer.

"I'm John Williams Cory IV, sir," said the boy proudly. "Your direct descendant through the Williams line, and —First in the Candidates Class." He said it proudly, a look of almost worshiping awe lighting his resolute young face. "That means, of course, that I

shall be the Sixteenth Leader when the great Dunn retires, and the sixth Cory —the sixth, sir!—to be called to that highest of all human stations, the Leadership!" The violet eyes so incongruous in that disciplined young face blazed with almost fanatic exaltation.

Behind him, a heavy-faced man moved forward, lifting the Roman salute, smiling wintrily beneath his steel helmet.

"I am Dunn, sir," he said in a voice as heavy as his features. "We've let Candidate Cory contact you because of the relationship, but it's my turn now to extend greetings from the System you made possible. I want to show it to you, but first let me thank you for founding the greatest family the United World has ever known. No other name has appeared more than twice on the great rôle of Leaders, but we have had five Corys—and the finest of them all is yet to come!"

Bill saw a wave of clear red mount his boy's proud, exalted face, and his own heart quickened with love and pride. For this was his son, by whatever name he went here. The memory of his lovely daughter had been drowned out momentarily in the deep uprushing of pride in this tall, blue-eyed boy with his disciplined face and his look of leashed eagerness. There was drive and strength and power of will in that young face now.

He scarcely heard Dunn's heavy voice from the room beyond the cube, so eagerly was he scanning the face of this son he yet might never have, learning almost hungrily the already familiar features, at once hard and eager and exultant. That mouth was his, tight and straight, and the cheeks that creased with deep hollows when he smiled, but the violet eyes were his mother's eyes, and the gentle inflexibility of Marta's courage at once strengthened and softened the features that were Bill's own. The best of them both was here, shining now with something more than either had ever known—an almost fanatic devotion to some stern purpose as exalting as worship, as inflexible as duty—

"Your own future, sir," Dunn was saying. "But our past, of course. Would you like to see it, Dr. Cory, so that you may understand just how directly we owe to you all that our world is today?"

"Yes—v-very much." Bill grinned at his own stammer, suddenly lighthearted and incredulous. All this was a dream. He knew that, of course. Why, the very coincidences in it proved that. Or—were they coincidences? Desperately he tried to clarify the thought taking form in his mind, a terrifyingly vast thought, terrifyingly without explanation. And yet it must be a dream— If it were real, then there was more than chance here. It could be no accident that these two children of his, groping blindly in the dark for contact with him, had succeeded at so nearly the same moment. There would be reason behind it, reason too vast for comprehension. He parted his lips to speak, but Dunn was already speaking.

"Look then, William Vincent Cory! Watch your own greatness unfolding in the years that lie ahead."

Hazily the scene in the cube blurred. The beloved, blue-eyed face of the boy he might never have, faded as a dream fades—a dream fading in a dream, he thought dimly—

THIS TIME it was Marta coming down the church aisle toward him, looking like a violet-eyed madonna coifed and veiled in white lace. He knew that he did not love her, now. His heart was still sore with the memory of Sallie. But love would come; with a woman like this it could not but come. There was tenderness and humor and passion on that raptly lifted face, and a strength that would call out the strength in him, not a weakness such as dimpled in Sal-

lie's face to evoke an underlying weakness in himself. For weakness was in him. He knew it. It would depend upon the woman who shared his life which quality overcame the other.

Life would be good with Marta. He saw it unfolding before him in a long succession of days, work and play and companionship that brought out the best in both. And the memory of the strange vision in which he thought he loved Sallie faded. This was the woman he loved. Her courage and humor, her violet eyes bright with pride of him—

Life went by—clear, condensed, swift. He saw his own work moving steadily toward success, Marta's eager encouragement tiding him over the low ebbs when difficulties threatened. She was so full of pride in her brilliant young husband that her enthusiasm almost ran away with her. It was she who insisted upon making the discovery public.

"I want to flaunt you before the world!" she urged. "Let's report to the Council now, darling. Aw, please, Bill!"

"We're not ready yet," he protested feebly. "Let's wait—"

"What for? Look." She shook a record sheet under his nose. "A hundred per cent success in the last dozen experiments! What more do you want? It's time to make an official report—announce what you're doing to the world! You've been all the way from fruit flies to monkeys. You'll have to make a report to the Council anyhow before you can take the next step. And remember, darling, when you come to that, I'm first in line as a candidate."

He seized her shoulders in a heavy grip, frowning down into the eagerness of her lifted face. "There'll be no guinea pigs in this family! When Junior Cory comes into the world he—or she—will do it without benefit of X rays. Understand?"

"But darling, I thought the whole idea was to give parents their choice of boys or girls in the family."

"The thing's not perfected yet to the point where I'd want to risk my own wife. And anyhow . . . anyhow, I've got a funny notion I'd rather just take what comes. Don't know why, exactly, but—"

"Bill, I do believe you're superstitious! Well, we'll fight that out later. But right now, you're going to make a full report of your success to the Council, and I'm going to be the proudest wife in the City. And that's final!"

So the report was made public. It created a tremendous furor; the world clamored for the magical stuff that would put the molding of the future into their hands. Bill Cory blushed and grinned for a delighted public in the telenews screens, promising the great gift soon, and Marta glowed with vicarious pride.

By the time he had made his first experiment with a human subject, the puppies which were the result of his first successful mammalian experiment were beginning to worry him a little. Miss Brown was the first to notice it. She came in from the kennels one day with a frown behind her steel-rimmed spectacles.

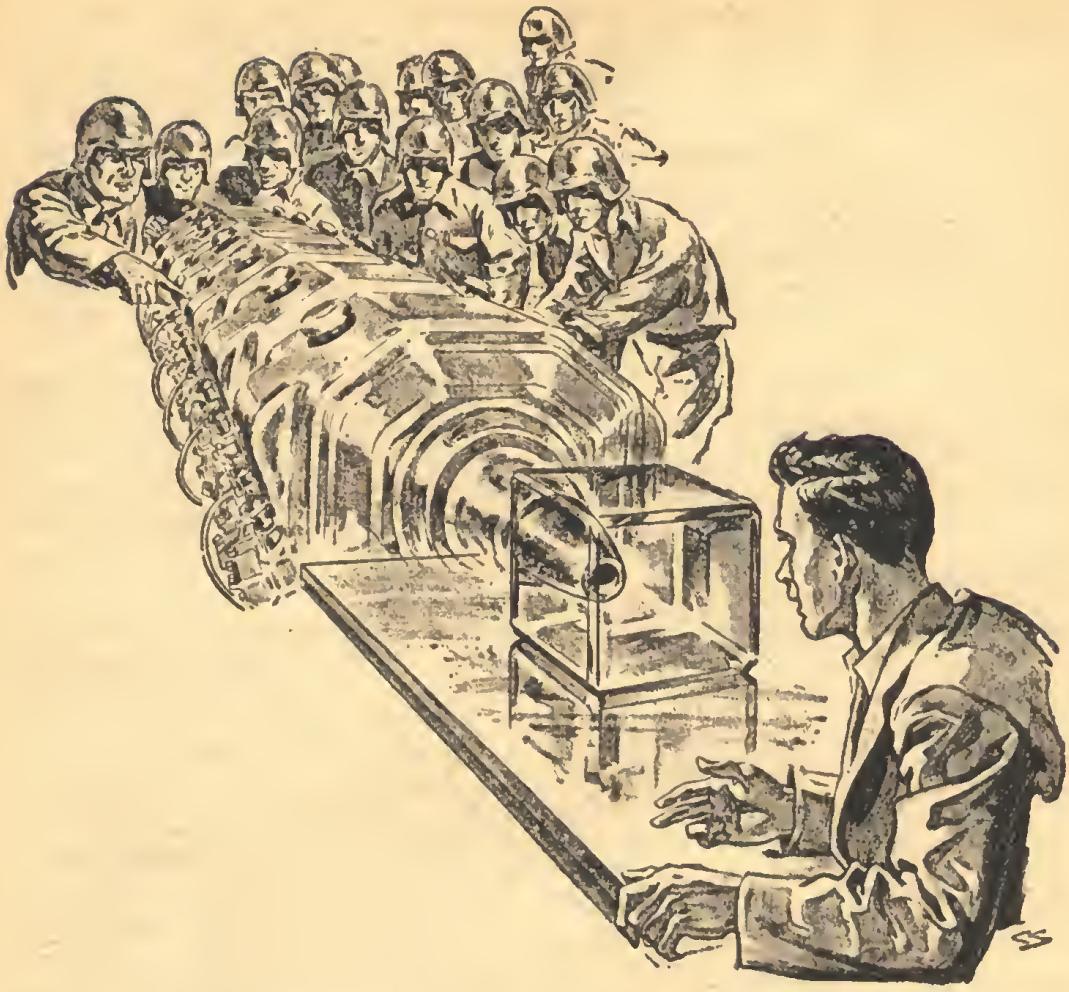
"Dr. Cory, has someone been training those dogs?"

"Training them?" Bill looked up, puzzled. "Of course not. Why?"

"Well, they've got the makings of the finest trained dogs on Earth. Either the whole lot of them is exceptionally intelligent or . . . or . . . something. They just fall over each other obeying every command you can make clear to them."

Bill straightened from his microscope. "Um-m-m . . . funny. Usually one or two dogs in a litter are more intelligent and obedient than the rest. But to have every one in six litters a canine genius is something pretty queer. What do you make of it?"

"I wouldn't call it genius, exactly. As



Beyond one cube, as real as he himself, seemingly, he saw that world of iron and blood and—triumph!

I say, I'm not sure if it's unusual intelligence or . . . well, maybe a strong strain of obedience, or lack of initiative, or . . . it's too soon to say. But they're not normal dogs, Dr. Cory."

IT WAS too soon to say. Tests simply showed the pups to be extraordinarily amenable to training, but what quality in them made this so was difficult to determine. Bill was not sure just what it implied, but an uneasiness in him woke and would not be quieted.

The first "X-ray" babies began to be born. Without exception they were fine, strong, healthy infants, and without exception of the predetermined sex. The Council was delighted; the parents were delighted; everyone was delighted except Bill. The memory of those oddly obedient pups haunted him—

Within three years the Cory System was available to the public. The experimental babies had made such an excellent showing that, in the end, Bill gave in to the insistent world, though something in the recesses of his mind urged delay. Yet he couldn't explain it. The babies were all healthy, normal, intelligent children. Unusually amenable to authority, yes, but that was an asset, not a liability.

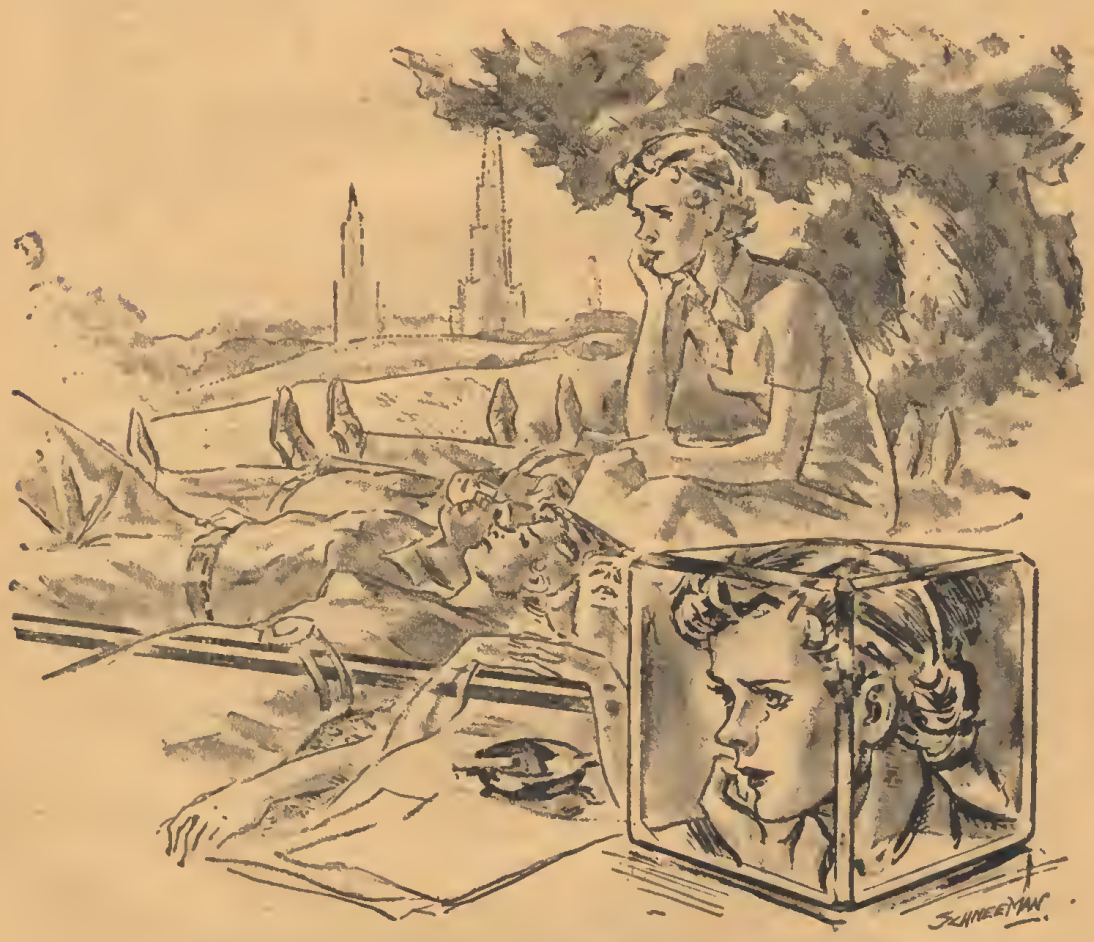
Presently all over the world the first crops of Cory System babies began to appear, and gradually Bill's misgivings faded. By then Bill Junior had arrived

to take his mind off other people's children, but even now he was obscurely glad that little Bill was a boy on his own initiative, not because his parents had forced masculinity upon him. There was no rhyme or reason to Bill's queer obsession that his own child should not be a product of the X-ray system, but he had been firm about it.

And in later years he had reason to be glad. Bill Jr. grew up fast. He had Marta's violet eyes and his father's darkly blond hair, and a laughing resolution all his own. He was going to be an architect, and neither his mother's shocked protest at this treason to the family profession, nor Bill's not wholly concealed disappointment could swerve him. But he was a good lad. Between school terms he and his father had entirely marvelous vacations together, and for Bill the world revolved about this beloved, talented, headstrong youngster whose presence upon Earth seemed reason enough for Bill's whole existence.

He was glad, even, that the boy *was* stubborn. For there could be no question now about a weakness in the children of the Cory System births. In all ways but one they were quite normal, it was true, but initiative seemed to have been left out of them. It was as if the act of predetermining their sex had robbed them of all ability to make any decisions of their own. Excellent followers they were—but no leaders sprang up among them.

And it was dangerous to fill with



Yet the world of the other cube. There was peace and thought and—a slow, comfortable decay!

unquestioning followers of the strongest man a world in which General George Hamilton controlled the United States. He was in his fourth term as president as the first great group of Cory System children came to maturity. Fiercely and sincerely he believed in the subjugation of the many to the State, and this new generation found in him an almost divinely inspired leader.

General George dreamed of a United World in which all races lived in blind obedience and willing sacrifice for the common good. And he was a man to make his dreams come true. Of course, he admitted, there would be opposition at first. There might be bloody wars, but in his magnificent dreams he believed sincerely that no price could be too high, that the end justified any means necessary to achieve it. And it seemed like the coöperation of Heaven itself to find almost an entire generation coming into adulthood ready to accept his leadership implicitly.

He understood why. It was no secret now what effect the Cory System had upon the children it produced. They would follow the strongest leader with blind faith. But upon this one generation of followers General George knew he could build a future that would live after him in the magnificent fulfillment of his most magnificent dreams. For a war lord needs a nation of soldiers, a great crop of boy babies to grow into armies, and surprisingly few saw the real motive behind General George's constant cry for boys, boys, boys—huge families of them. Fathers of many sons were feted and rewarded. Everybody knew there was the certainty of war behind this constant appeal for families of sons, but comparatively few realized that since the best way to be sure of boys was the use of the Cory System, the whole new generation would be blind followers of the strongest leader, just as their fathers were. Perhaps the Cory System might have died of its own great weakness, its one flaw, had not General George so purposefully demanded sons of his followers.

GENERAL GEORGE died before the first great war was over. His last words, gasped in the bursting tumult of a bomb raid over Washington were, "Carry on—unite the world!" And his vice-president and second in command, Phillip Spaulding, was ready to snatch up the falling torch and light the world to union.

Half the United States lay in smoking ruins before the Great War ended. But General George had builded well upon that most enduring of all foundations—the faith of men. "Be fruitful and multiply," was a command his followers had obeyed implicitly, and Spaulding had mighty resources of human brawn and human obedience to draw upon.

The great general had died gladly for his dream, and he had not died in vain. Half the world was united under his starry banners within a decade after his death; the United World of his vision came into being less than fifty years later.

With peace and blind faith and prosperity, Science City indeed came into its own. And because a taste of power had made the Leaders hungry, the eyes of the City turned upward toward starry space. During the command of the Fourth Leader after the immortal General George, the first successful space voyage was achieved. The first living man stood knee-deep in the dead pumice dust of the moon and a mighty forward stride for mankind was recorded.

It was only a step. Mars came next, three generations later. After a brief and bloody war, its decadent inhabitants surrendered and the Seventh Leader began to have giddily intoxicating dreams of a United Solar System—

Time telescoped by. Generation melted into generation in changing tides

over a world population that seemed unaltering in its by now age-old uniforms of George Blue. And in a sense they were unaltering. Mankind was fixed in a mold—a good enough mold for the military life of the U. W.—the United World. The Cory System had long ago become compulsory, and men and women were produced exactly in the ratio that the Leaders decreed. But it was significant that the Leader class came into the world in the old haphazard fashion of the days before the legendary Dr. Cory's discovery.

The name of Cory was a proud one. It had long been a tradition in that famous family that the founder's great System should not be used among themselves. They were high among the Leader class. Several of the Leaders had borne the surname of Cory, though the office of course was not hereditary, but passed after rigid training and strict examination to the most eligible of the Candidates Class when an old Leader passed his prime.

And among the mighty Corys, family resemblance was strong. Generations saw the inevitable dilution of the original strain, but stubbornly through the years the Cory features came and went. Sometimes only the darkly blond hair of the first great Bill, sometimes the violet eyes which his pretty Marta had bequeathed her son, sometimes the very face of young Bill Jr. himself, that had roused an ache of pride and love in his father's heart whenever he saw those beloved features.

The Cory eyes looked now upon two worlds, triumphantly regimented to the last tiny detail. Mankind was proving his supremacy over himself—over his weaknesses and his sentimental, selfish desires for personal happiness as opposed to the great common good. Few succumbed to such shameful yearnings, but when they did, every man was a spy against his neighbor, as stern as the Leader himself in crushing these threats to the U. W.'s strength. It should be the individual's holiest and most mystically passionate dream to sacrifice his happiness for the Leader and the U. W., and the Leader and the United World lived for the sole purpose of seeing that he did.

Marvelous was the progress of mankind. The elements had long since been conquered; the atom had yielded up its incalculable power in the harness of the machines, space itself was a highway for the vehicles of the U. W.

Under the blue-black skies of Mars, mankind's checkerboard cities patterned the hot red soil; under the soft gray clouds of Venus, those roofed and checkered cities spread from a common center through jungles steaming in more than tropic heat. Many-mooned Jupiter was drawing the covetous eyes of the Leaders in their sky-high cities of glass and steel.

And moving through these patterned cities upon three worlds, the followers of the Leader went about their ways, resolute, unfaltering, their faces set in one pattern of determination.

It was not a happy pattern. There was little laughter here; the only emotion upon the serious faces, aside from the shadow of that same exaltation that blazed in the Leader's eyes, was a subtle furtiveness, a sidelong quality that by intuition seemed to distrust its neighbors. Bill recognized it. Every man's duty was to sacrifice for the Cause not only his personal desires and happiness, but his personal honor as well; he must keep relentlessly alert for traitorous weakness in his friends, his associates, his own family.

Mistily the panorama of the centuries began to melt into itself, to fade, while behind it a blue-eyed face, helmed in blue steel, took form to smile straight into Bill's eyes. A tense, expectant smile, supremely confident.

BILL SAT BACK and breathed deeply, avoiding for a moment the proudly smiling face of his son. "I'm —there!" he was thinking. "That was me being born again and again, working with all my heart to crush out human happiness— But there was Sue, too, generations of her—yes, and of me —working just as sincerely toward an opposite goal, a world without war. Either way they've got me. If I don't finish my work, the world unbalances toward matriarchy; if I do, mankind turns into a machine. It's bad. Either way it's bad—"

"The doctor is almost overwhelmed at the realization of his own greatness," Dunn's voice murmured from the window into the future. Bill recognized it for a sort of apology, and sat up with an effort to meet the pride-bright eyes of the boy who one day might be his son. There was nothing but happy expectancy of praise on the boy's face, but Dunn must have read a little doubt in Bill's, for he said heavily, as if to overwhelm that doubt:

"We build toward one common end, all of us—we have no thought for any smaller purpose than the conquest of the Solar System for the mighty race of man! And this great purpose is yours no less than ours, Dr. Cory."

"Manpower is what counts, you know, sir." Young Billy's voice took up the tale as Dunn's died. "We've got tremendous reserves, and we're piling up still more. Lots of room yet on Mars to fill up, and Venus is almost untouched yet. And after that, we'll breed men and women adapted to Jupiter's gravity, perhaps . . . oh, there'll be no end to our power, sir! We'll go on and on — Who knows? There may come a day when we're a United Universe!"

For an instant, hearing the young voice shake with eagerness, Bill doubted his own doubtfulness. The mighty race of man! And he was part of it, living in this far-off future no less than he lived now in the flesh, in the burning ardor of this iron-faced boy. For a moment he forgot to be amazed and incredulous that he stood in the Twenty-third Century and looked as if through a window into the Thirtieth, talking with the unborn descendant of his yet unconceived son. For this moment it was all accomplished reality, a very magnificent and blood-stirring present achieved directly through his own efforts.

"Father . . . father!" The voice was sweet and high in the core of his brain. And memory came back in an overwhelming rush that for an instant drowned out everything but a father's awareness of special love for a favorite daughter.

"Yes, Susan . . . yes, dear." He murmured it aloud, swinging around toward the cube that housed his other future. Sue leaned forward upon her knees among the myrtle leaves, her brown eyes wide and a little frightened upon his. There was a crease between her winged brows that dented Bill's own forehead as he faced her. For a moment it was almost as if each of them looked into a mirror which reflected the features of the other, identical in nearly every detail. Then Sallie's smile dimpled the cheeks of her far-descended daughter, and Sue laughed a small, uneasy laugh.

"What is it, father? Is something wrong?"

He opened his lips to speak—but what could he say? What could he possibly say to her, who did not even dream that her own time was anything but inevitable? How could he explain to a living, warmly breathing woman that she did not exist, might never exist?

He stared at her unhappily, groping for words he could not find. But before he spoke—

"Dr. Cory, sir— Is anything wrong?" He turned back to Billy with a harried crease between his brows and then stared wildly from one face to the other. How

could they help hearing one another? But obviously Billy, from his window into the present, saw simply the cube that held Sallie's immortal smile, while Sue, from hers, looked upon Marta's changeless face. It seemed to Bill that the boy and the girl had spoken in voices almost identical, using words nearly the same, though neither was aware of the other. How could they be? They could not even exist simultaneously in the same world. He might have one of these beloved children or the other; not both. Equally beloved children, between whom he must choose —and how could he choose?

"Father—" said Sue on a rising inflection of alarm. "There *is* something wrong. I . . . feel it in your mind— Oh, what is it, father?"

Bill sat speechless, staring from one face to the other of these mutually exclusive children. Here they stood, with their worlds behind them, looking anxiously at him with the same little crease between the brows of each. And he could not even speak to either without convincing the other he was a madman talking to empty air. He wanted insanely to laugh. It was a deadlock beyond all solution. Yet he must answer them—he must make his choice—

AS HE SAT there groping in vain for words, a curious awareness began to take shape in his mind. How strange it was that these two should have been the ones to reach him, out of all the generations behind each that had been searching the past. And why had they established contact at so nearly the same time, when they had all his life span to grope through, hunting him for such different reasons, in such different ways? There was more than accident here, if all this were not a dream—

Billy and Sue—so similar despite the wide divergence of their words, a wider divergence than the mind can well grasp, for how can one measure the distance between mutually incompatible things? Billy who was all of Bill Cory that was strong and resolute and proud; Sue, who incarnated his gentler qualities, the tenderness, the deep desire for peace. They were such poles apart—why, *they were the poles!* The positive and negative qualities that, together, made up all that was best in Bill Cory. Even their worlds were like two halves of a whole; one all that was strong and ruthless, the other the epitome of gentle, abstract idealism. And both were bad, as all extremes must be.

And if he could understand the purpose behind the fact that these two poles of human destiny had reached back in their own pasts to find him at the same moment—if he could understand why the two halves of his soul, split into positive and negative entities, stood here clothed almost in his own flesh to torture him with indecision, perhaps—

He could not choose between them, for there was no choice, but there was a deeper question here than the simple question of conduct. He groped for it blindly, wondering if the answer to everything might not lie in the answer to that question. For there was purpose here vaster than anything man has words for—something loomed behind it to shadowy heights that made his mind reel a little as he tried to understand.

He said inadequately to both his staring children: "But why . . . how did you . . . at this very moment out of all time—"

To Billy it was mere gibberish, but Sue must have understood the question in his mind, for after a moment, in a puzzled murmur, she said:

"I—don't know, exactly. There *is* something here beyond the simple fact of success. I . . . I feel it— I can sense something behind my own actions that . . . that frightens me. Something guiding and controlling my own mind— Oh, father, father, I'm afraid!"

Every protective instinct in him

leaped ahead of reason in Bill's instant. "Don't be frightened, honey! I won't let anything happen to you!"

"Dr. Cory!" Young Billy's voice cracked a little in horror at what must have sounded to him like raving madness. Behind him, staring faces went tense with bewilderment. Above their rising murmurs Sue wailed, "Father!" in a frightened echo to Billy's, "Dr. Cory, are you ill, sir?"

"Oh, wait a minute, both of you!" said Bill wildly. And then in a stammer, to stop Billy's almost hysterical questions, "Your . . . your sister—Oh, Sue, honey, I hear you! I'll take care of you! Wait a minute!"

In the depths of the cube the boy's face seemed to freeze, the eyes that were Marta's going blank beneath the steel cap, Bill's very mouth moving stiffly with the stiffness of his lips.

"But you never had a daughter—"

"No, but I might have, if—I mean, if I'd married Sallie of course you'd never even— Oh, God!" Bill gave it up and pressed both hands over his eyes to shut out the sight of the boy's amazed incredulity, knowing he'd said too much, yet too numbed and confused now for diplomacy. The only clear idea in his head was that he must somehow be fair to both of them, the boy and the girl. Each must understand why he—

"Is the doctor ill, Candidate Cory?" Dunn's voice was heavy from the cube.

Bill heard the boy's voice stammering: "No—that is, I don't—" And then, faltering, more softly: "Leader, was the great doctor ever—mad?"

"Good God, boy!"

"But—speak to him, Leader!"

Bill looked up haggardly as Dunn's voice rolled out with the sternness of a general addressing armies. "Pull yourself together, sir! You never had a daughter! Don't you remember?"

Bill laughed wildly. "Remember? I've never even had a son yet! I'm not married—not even engaged! How can I remember what hasn't happened?"

"But you *will* marry Marta Mayhew!

You did marry her! You founded the great line of Corys and gave the world your—"

"Father . . . father! What's wrong?" Sue's sweet wail was in his ears. He glanced toward her window momentarily, seeing the terror in the soft brown eyes that stared at him, but he could only murmur: "Hush, darling—wait, please!" before he faced the Leader and said with a strong effort at calmness, "None of all that has happened—yet."

"But it will—it must—it *did!*"

"Even if I never married Marta, never had a son?"

Dunn's dark face convulsed with a grimace of exasperated anger.

"But good Lord, man, look here!" He seized Billy's blue-uniformed shoulders with both hands, thrusting him forward. "You did have a son! This is his descendant, the living likeness of young Cory Junior! This world . . . I myself . . . all of us . . . we're the result of that marriage of yours! And you never had a daughter! Are you trying to tell us we don't exist? Is this a . . . a dream I'm showing you?" And he shook the boy's broad young shoulders between his hands. "You're looking at us, hearing us, talking to us! Can't you see that you must have married Marta Mayhew?"

"Father, I want you! Come back!" Sue's wail was insistent.

Bill groaned. "Wait a minute, Dunn." And then, turning, "Yes, honey, what is it?"

ON HER KNEES among the myrtle leaves Sue leaned forward among the sun-flecked shadows of her cool green glade, crying: "Father, you won't . . . you can't believe them? I heard . . . through your ears I heard them, and I can understand a little through your mind linked with mine. I can understand what you're thinking . . . but it can't be true! You're telling yourself that we're still on the Probability Plane . . . but that's just a theory! That's nothing but a speculation about the future! How could I be anything but real? Why, it's silly! Look at me! Listen to me! Here I am! Oh, don't let me go on thinking that maybe . . . maybe you're right, after all. But it *was* Sallie Carlisle you married, wasn't it, father? Please say it was!"

Bill gulped. "Wait, honey. Let me explain to them first." He knew he shouldn't have started the whole incredible argument. You can't convince a living human that he doesn't exist. They'd only think him mad. Well—Sue might understand. Her training in metaphysics and telepathy might make it possible. But Billy—

He turned with a deep breath and a mental squaring of shoulders, determined to try, anyhow. For he must be fair. He began: "Dunn, did you ever hear of the Plane of Probability?"

At the man's incredulous stare he knew a dizzy moment of wonder whether he, too, lived in an illusion as vivid as theirs, and in that instant the foundations of time itself rocked beneath his feet. But he had no time now for speculation. Young Billy must understand, no matter how mad Dunn believed him, and Sue must know why he did what he must do—though he didn't understand himself, yet, what that would be. His head was ringing with bewilderment.

"The . . . the Plane of Probability?" In Dunn's eyes upon his he saw a momentary conviction flare that, reality or not, and history be damned, this man was mad. And then, doubtfully, the Leader went on, "Hm-m-m . . . yes, somewhere I *have* heard— Oh, I remember. Some clap-trap jargon the old Telepathy House fakers used to use before we cleared them out of Science City. But what's that nonsense got to—"

"It's not nonsense." Bill closed his

eyes in a sudden, almost intolerable longing for peace, for time to think what he must do. But no, the thing must be settled now, without time for thinking. And perhaps that was the best way, after all. A man's brain would crack if he paused to think out this madness. Only he must say something to young Billy—And what could he say? How could he face either of these beloved children and, to their uncomprehending, pleading faces, refuse them life? If he could only break the connection that riveted them all into a sort of triple time balance—But he couldn't. He must make it clear to Billy—

"It's not nonsense," he heard his own voice repeating wildly. "The future—you and your world—is a probability only. I'm a free agent. If I never marry Marta, never perfect the sex-determination idea, the probable future shifts to . . . to another pattern. *And that as bad as yours, or worse!*" he finished to himself.

"Is he mad?" Billy's voice was a whisper in the screen.

The Leader said as if to himself, in an awed and stumbling voice, "I don't . . . I can't . . . the thing's preposterous! And yet he *is* unmarried, the Great Work's still unfinished. Suppose he never— But we're real! We're flesh and blood, aren't we? He stamped a booted foot on the floor as if to test the foundations of his world. "We're descended in an unbroken line from this . . . this madman. Lord in heaven, are we all mad?"

"Father! Come back!" Sue's voice shrilled in Bill's ears. He turned desperately, glad of an excuse to escape the haunted stares from that other window even though he must face hers. She had risen to her feet among the myrtle leaves. The glade was cool and still about her in this lazy, sunlit world of her own future. She was crying desperately, "Don't listen, father! I can feel the confusion in your mind. I know what they're saying! But they aren't real, father—they can't be! You never had a son, don't you remember? All this you're saying is just . . . just talk, isn't it? That silly stuff about the Probability Plane—it's nothing but speculation! Oh, say it is, father! We've got such a lovely world, we love living so . . . I want to live, father! I *am* real! We've fought so hard, for so many centuries, for peace and happiness and our beautiful garden world. Don't let it snuff out into nothingness! But"—she laughed uncertainly—"how could you, when it's all around us, and has been for thousands of years? I . . . oh, father!" Her voice broke on a little quivering gulp that made Bill's heart quiver with it, and he ached intolerably with the rising of her tears. She was his to protect and cherish, forever. How could he—

"Dr. Cory—do you hear me? Oh, please listen!" Young Billy's familiar voice reached out to him from that other future. He glanced toward him once, and then put his hands to his ears and whirled from them both, the two voices mingling in an insane chaos of pleading.

SUE ON HER myrtle bank in a future immeasurably far ahead, child of a decadent world slipping easily down the slope of oblivion.

Billy's world might be as glorious as he believed, but the price was too high to pay for it. Bill remembered the set, unsmiling faces he had seen in the streets of that world. These were men his own work had robbed of the initiative that was their birthright. Happiness was their birthright, too, and the power to make the decisions that determined their own futures.

No, not even for such achievements as theirs must mankind be robbed of the inalienable right to choose for himself. If it lay in Bill Cory's power to outlaw a system which destroyed men's freedom and honor and joy, even for

such an end as mankind's immortal progress, he had no choice to make. The price was too high. Confusedly he remembered something out of the dim past: "What shall it profit a man if he gain the whole world and lose his own soul. . . .?"

But—the alternative. Bill groaned. Happiness, peace, freedom, honor—yes, Sue's world had all that Billy's lacked. And to what end? Indolence and decadence and extinction for the great race that Billy's civilization would spread gloriously among the stars.

"But I'm thinking of *choice*," groaned Bill to himself. "And I haven't got any choice! If I marry Sallie and don't finish my work—one future follows. If I marry Marta and do finish it, the other comes. And both are bad—but what can I do? Man or mankind; which has the stronger claim? Happiness and extinction—or unhappiness and splendid immortality; which is better?"

"Cory—Dr. Cory!" It was Dunn's voice, heavy enough to break through the daze of bewilderment that shrouded Bill's brain. He turned. The Leader's iron-hard face under the steel helmet was settling into lines of fixed resolution. Bill saw that he had reached some decision, and knew a sudden, dazed admiration for the man. After all, he had not been chosen Leader for nothing.

"You're a fool to tell us all this, Cory. Mad, or a fool, or both. Don't you know what it means? Don't think we established this connection unprepared for trouble! The same force that carries the sight and sound of us from our age to yours can carry destruction, too! Nowhere in our past is there a record that William Cory was killed by a blast of atom-gun fire as he sat at his desk—but, by God, sir, if you can change that past, so can we!"

"It would mean wiping yourself out, you know," Bill reminded him as steadily as he could, searching the angry eyes of this man who must never have faced resolute opposition before, and wondering if the man had yet accepted a truth that must seem insanely impossible to him. He wanted overwhelmingly to laugh, and yet somewhere inside him a chilly conviction was growing that it might be possible for the children of his unborn son; in a future that would never exist, to blast him out of being. He said: "You and your whole world would vanish if I died."

"But not unavenged!" The Leader said it savagely, and then hesitated. "But what am I saying? You've driven me almost as mad as you! Look, man, try to be sensible! Can you imagine yourself dissolving into nothingness that never existed? Neither can I!"

"But if you could kill me, then how could your world ever have been born?"

"To hell with all that!" exploded

Dunn. "I'm no metaphysician! I'm a fighting man! I'll take the chance!"

"Please, Dr. Cory—" Billy pressed forward against the very surface of the cube, as if he could thrust himself back into his own past and lay urgent hands upon this man so like him, staring white-faced and stubborn into the future. Perhaps it was more than the desire for peace that spoke in his shaken voice. If Bill Cory, looking into that young face so like his own, had felt affection and recognition for it, then must not the boy know a feeling akin to it as he saw himself in Cory's features? Perhaps it was that subtle, strange identification between the two that made the boy's voice tremble a little as if with the first weakening of belief. When he spoke he seemed to be acknowledging the possibility of doubt, almost without realizing it. He said in that shaken, ardent voice:

"Please, try to understand! It's not death we're afraid of. All of us would die now, willingly, if our deaths could further the common good. What we can't endure to face is the death of our civilization, this marvelous thing that makes mankind immortal. Think of that, sir! This is the only right thing possible for you to do! Would we feel so strongly if we weren't *sure?* Can you condemn your own race to eternity on one small planet, when you could give them the universe to expand in and every good thing science can offer?"

"Father . . . father!" It was Sue again, frantic and far away.

BUT BEFORE Bill could turn to her, Dunn's voice broke in heavily over both the others. "Wait—I've made up my mind!" Billy fell back a little, turning to his Leader with a blaze of sudden hope. Bill stared. "As I see it," went on Dunn, "the whole preposterous question hinges on the marriage you make. Naturally I can't concede even to myself that you could possibly marry anyone but the woman you *did* marry—but if you honestly feel that there's any question in your own mind about it, I'll settle it for you."

He turned to nod toward a corner of the room in which he stood that was outside Bill's range, and in a moment the blue-uniformed, staring crowd about him parted and a low, rakish barrel of blue-gleaming steel glided noiselessly forward toward that surface of the cube which was a window into the past-future that parted Bill and themselves. Bill had never seen anything like it before, but he recognized its lethal quality. It crouched streamlined down upon its base as if for a lunge, and its mouth facing him was a dark doorway for death itself. Dunn bent behind it and laid his hand upon a half-visible lever in its base.

"Now," he said heavily. "William Cory, there seems to be a question in your mind as to whether we could reach you with our weapons. Let me assure you that the force-beam which connects us can carry more than sight and sound into your world! I hope I shan't have to demonstrate that. I hope you'll be sensible enough to turn to that televisor screen in the wall behind you and call Marta Mayhew."

"M—Marta?" Bill heard the quiver in his voice. "Why—"

"You will call her, and in our sight and hearing you are going to ask her to marry you. That much choice is yours, marriage or death. Do you hear me?"

Bill wanted insanely to laugh. Shotgun wedding from a mythical future—"You can't threaten me with that popgun forever," he said with a quaver of mirth he could not control. "How do you know I'll marry her once you're away?"

"You'll keep your word," said Dunn serenely. "Don't forget, Cory, we know you much better than you know yourself. We know your future far more completely than you saw it. We know

how your character will develop with age. Yes, you're an honorable man. Once you've asked her to marry you, and heard her say yes—and she will—you won't try to back out. No, the promise given and received between you constitutes a marriage as surely as if we'd seen the ceremony performed. You see, we trust your honor, William Cory."

"But—" Bill got no further than that, for explosively in his brain a sweet, high voice was sobbing:

"Father, father, what are you doing? What's happened? Why don't you speak to me?"

In the tension Bill had nearly forgotten Sue, but the sound of that familiar voice tore at him with sudden, almost intolerable poignancy. Sue—the promise to protect her had risen to his lips involuntarily at the very mention of danger. It was answer to an urgency rooted race-deep, the instinct to protect the helpless and the loved. For a moment he forgot the gun trained on him from the other window; he forgot Billy and the world behind him. He was conscious only of his daughter crying in terror for help—for help from him and for protection against him at once, in a dizzy confusion that made his head swim.

"Sue—" he began uncertainly.

"Cory, we're waiting!" Dunn's voice had an ominous undernote.

BUT THERE WAS a solution. He never knew just when he first became aware of it. A long while ago, perhaps, subconsciously, the promise of it had begun to take shape in his mind. He did not know when he first realized that—but he thought he knew whence it came. There was a sureness and a vastness about it that did not originate in himself. It was the Cosmic Mind indeed in which his own small soul was floundering, and out of that unthinkably limitless Plan, along with the problem came at last the solution. *(There must be balance . . . the force that swings the worlds in their orbits can permit of no question without an answer—)*

There was no confusion here; there had never been. This was not chance. Purpose was behind it, and sudden confidence came flooding into him from outside. He turned with resolution so calm upon his face that Billy sighed and smiled, and Dunn's tense face relaxed.

"Thank God, sir," breathed Billy, "I knew you'd come to your senses. Believe me, sir, you won't be sorry."

"Wait," said Bill to them both, and laid his hand on the button beneath his desk that rang a bell in his laboratory. "Wait and see."

In three worlds and times, three people very nearly identical in more than the flesh alone—perhaps three facets of the same personality, who can say?—stood silent and tense and waiting. It seemed like a very long time before the door opened and Miss Brown came into the room, hesitating on the threshold with her calm, pleasant face questioning.

"You want me, Dr. Cory?"

Bill did not answer for a moment. He was pouring his whole soul into this last long stare that said good-by to the young son he would never know. For understanding from some vast and nameless source was flooding his mind now, and he knew what was coming and why it would be so. He looked across the desk and gazed his last upon Sue's familiar face so like his own, the fruit of a love he would never share with pretty Sallie. And then, drawing a deep breath, he gulped and said distinctly:

"Miss Brown, will you marry me?"

Dunn had given him the key—a promise given and received between this woman and himself would be irrevocable, would swing the path of the future into

a channel that led to no world that either Billy or Sue could know.

Bill got his first glimmer of hope for that future from the way the quiet woman in the doorway accepted his question. She did not stare or giggle or stammer. After one long, deep look into his eyes—he saw for the first time that hers were gray and cool behind the lenses—she answered calmly.

"Thank you, Dr. Cory. I shall be very happy to marry you."

AND THEN—it came. In the very core of his brain, heartbreak and despair exploded in a long, wailing scream of faith betrayed as pretty Sue, his beloved, his darling, winked out into the oblivion from which she would never now emerge. The lazy green Eden was gone forever; the sweet fair girl on her knees among the myrtle leaves had never been—would never be.

Upon that other window surface, in one last flash of unbearable clearness, young Billy's incredulous features stared at him. Behind that beloved, betrayed face he saw the face of the Leader twisting with fury. In the last flashing instant while the vanishing, never-to-exist future still lingered in the cube, Bill saw an explosion of white-hot violence glare blindingly from the gun mouth, a heat and violence that seared the very brain. Would it have reached him—could it have harmed him? He never knew, for it lasted scarcely a heartbeat before eternity closed over the vanishing world in

a soundless, fathomless, all-swallowing tide.

Where that world had stretched so vividly a moment ago, now Marta's violet gaze looked out into the room through crystal. Across the desk Sallie's lovely, careless smile glowed changelessly. They had been gateways to the future—but the gates were closed. There would never be such futures now; there never had been. In the Cosmic Mind, the great Plan of Things, two half-formed ideas went out like blown candle flames.

And Bill turned to the gray-eyed woman in the doorway with a long, deep, shaken sigh. In his own mind as he faced her, thoughts too vast for formulation moved cloudily.

"I know now something no man was ever sure of before—our oneness with the Plan. There are many, many futures. I couldn't face the knowledge of another, but I think—yes, I believe, ours will be the best. She won't let me neglect the work we're doing, but neither will she force me to give it to the world unperfected. Maybe, between us, we can work out that kink that robs the embryo of determination, and then—who knows?

"Who knows why all this had to happen? There was Purpose behind it—all of it—but I'll never understand just why. I only know that the futures are infinite—and that I haven't lost Billy or Sue. I couldn't have done what I did without being sure of that. I couldn't lose them, because they're me—the best of me, going on forever. Perhaps I'll never die, really—not the real me—until these incarnations of the best that's in me, whatever form and face and name they wear, work out mankind's ultimate destiny in some future I'll never see. There was reason behind all this. Maybe, after all, I'll understand—some day."

He said nothing aloud, but he held out his hand to the woman in the door and smiled down confidently into her cool, gray eyes.

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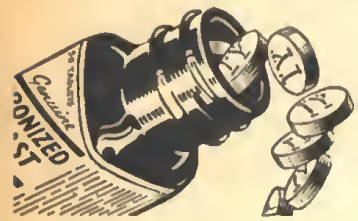

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