Hurling a Man to the Moon

How could a lunar Columbus break the grip of gravitation and reach the nearest heavenly body? What kind of motor would he use? How much power would it take?

By Waldemar Kaempffert and A. J. Lorraine

THERE in the heavens shines the moon—240,000 miles away. How can I bridge that awful chasm? Others have asked that question of themselves before me. Most of them have been novelists or scientific romancers. I am not a novelist, but an engineer, and it is as an engineer that I ask myself the question.

Two hundred and forty thousand miles! The distance alone seems hopeless. And yet, the distance that I must traverse gives me little concern. If I could take an express train I could easily reach the moon in six months. If I could use a fast airplane, a 120-mile-an-hour fighting-machine, it would be a matter of only three months before I beheld at close range the scarred and pitted surface of the moon.

The Distance Is Not the Important Thing

Two hundred and forty thousand miles are nothing. The captain of the fastest transatlantic steamer covers as many miles once every three years; the conductor of a speedy railway train in even less time.

No, it is not distance that perplexes me, but a barrier more formidable than all the ice and snow, all the gnawing cold that guards the approach to the earth's poles. What is it—this barrier? Nothing—absolutely nothing. I am not trying to dismiss it by calling it nothing; for when I refer to "nothing" I mean the utter void of interstellar space. To be sure, the physicists say that the space between the stars is occupied by the "ether." That does not make the void any less a void for my practical engineering purpose.

You will understand my predicament better if you consider the means that we employ to move ourselves about mechanically on the earth. Every transporting vehicle that we use reacts in some way on its environment. The locomotive grips rails by friction. The balloon is buoyed up by the surrounding atmosphere. I find that the greatest height ever attained by a man in a balloon is 35,420 feet. Beyond a certain height a gas-bag will not rise; there is not enough air.

It can no more leave the atmosphere and float about in empty space than a fish can leave the water and sail in the air.

I am trying merely to make the point that, just as the locomotive needs rails or an automobile a road, so a balloon needs air. Between the stars there is no air—only that baffling void. The airplane serves me no better than a balloon. It, too, reacts upon its environment. What keeps it up? Pressure beneath its wings—air-pressure. Hence, like the balloon, it can go so high, and no higher. I find that the altitude record for an airplane is 30,500 feet, made recently by an American aviator, Captain Lang. Without air a plane cannot fly. I repeat: there is no air between the stars.

Suppose it were possible for you to stand between two stars. The side that you presented to the sun would be exposed to his blaze, while the dark side would be frozen

It is clear that all the propulsive engines that man uses to transport himself from place to place on the earth are useless for my purpose. Like man himself, they are earth-bound. I must cast about for radically different means of locomotion—some mechanism that is independent of any reaction on its environment.

There in the heavens shines the moon—two hundred and forty thousand miles away. How can I bridge that awful chasm?

Jules Verne once wrote a novel, "From the Earth to the Moon," in which he tried to reason with something like scientific sobriety that a gun might propel a man to the moon. He literally shot his hero through 240,000 miles of space. Will a huge gun answer my purpose?

Is There Any Limitation to Gravity?

In the first place, I must consider gravity. It ties us to the earth as if by an elastic band. Throw a stone up into the air, or fire a shell from an anti-aircraft gun. The stone or the shell rises to a certain point, and then it falls back as if it were pulled down by a stretched spring.

Now, an elastic band or a stretched spring has its limitations. If we strain it beyond a certain point it snaps. Is there anything corresponding in the case of gravity? I know that the analogy must not be pressed too closely. But this is true: If I could shoot a projectile from a gun with a greater and greater velocity, a point would ultimately be reached when, instead of returning to the earth, the projectile would continue to travel on an independent course through space.

A Shot Fired from the North Pole

I am dealing now with measurable forces. Huge guns have been built, and their muzzle velocities are known. Suppose I were to mount a gun at the North Pole and fire my shot at a sufficient altitude to clear all obstacles. What muzzle velocity would I have to attain so that if I were shot out, safely encased in a projectile, I would never fall back to the earth?

The calculation is simple enough. What is the result? Twenty-six thousand feet per second would have to be the speed of the projectile in which I am housed when it leaves the gun. I would keep on traveling in a circle around the globe. Indeed, I would become a satellite of the earth—a living moon.

The Projectile Would Become a Satellite

If I could illuminate the projectile in which I sit, you would see me rising every one and a half hours at the horizon; you would see me traveling across the sky in about forty-five minutes, and setting at the opposite point of the horizon. I would be a busy little moon; for I would rise and set as many as eight times in a twelve-hour night.

But I do not want to travel perpetually around the earth. I want to reach the moon. Hence my muzzle velocity must be greater than 26,000 feet per second. If it is somewhat greater, my path, as I sit in my projectile, would at first be drawn out into an oblong, or ellipse. Still, at regular intervals, I would always return to my starting-point.

I find that I must increase my velocity to about 37,000 feet (seven miles) a second if I am to leave the earth in my projectile for good and all and to travel forever farther and farther away from it. It is as if the elastic band were torn: gravity no longer confines me and my projectile to an orbit around the earth.

Thirty-seven thousand feet a second! It is stupendous. Can I attain it? Let us see what has actually been done by some of our big modern guns. What are some of the records? Our fourteen-inch naval guns, which in the great world war were mounted upon railway trucks and leveled at the German army, fired shells with a speed of 2,800 feet a second. A six-inch wire-wound experimental gun tested at Sandy Hook attained a muzzle velocity of 3,850 feet a second. It had but a short life. No doubt the highest muzzle velocity ever attained was that of the 75-mile gun with which the Germans bombarded Paris. Artillery officers have estimated that the initial velocity of its shell must have been from 5,000 to 5,500 feet a second—only one seventh of that required to hurl me to the moon. That German gun represents the limit of our present technical resources, so far as gun-making is concerned.

But not yet will I abandon the idea of reaching the moon by shooting myself from the earth. If one gun carries seventy-five miles, how far will two guns carry? I am not trying to joke; this is no facetious application of the rule of three. I find in the patent records of the United States and other countries more than one such method of thus multiplying the power of guns in order to increase the range.

Over and over again inventors have suggested that it may be possible to fire a gun within a gun. Such is the timing arrangement that when the projectile—that is to say, the inner gun—has reached a certain point, it in turn is fired, and the shell projected from it proceeds with a new velocity to its destination. If two guns, one within the other, should prove practicable, why not three, five, eight, or a dozen?

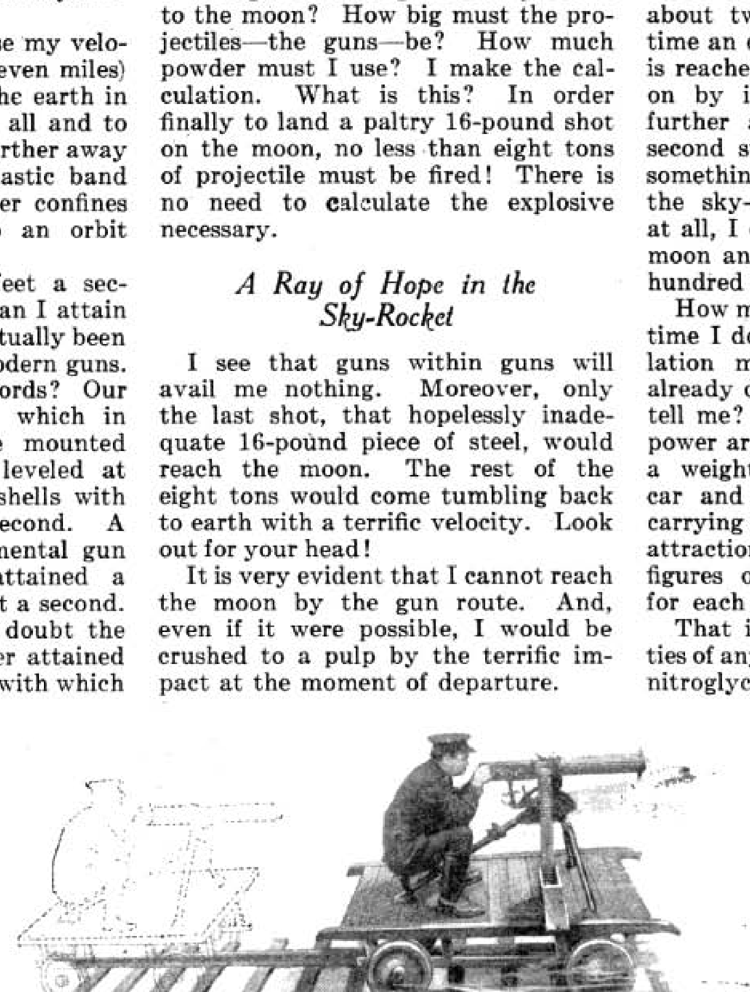
This is precisely what a French army officer, writing in the *Revue du Ciel*, proposes (not very seriously, it is true) as the expedient to be adopted in an imaginary war between the earth and the moon. He assumes an initial velocity of 12,300 feet a second, which, he thinks, is within the limits of possibility in the future. His projectile consists of twelve shells, one within the other—and the final bullet.

Will guns within guns transport me to the moon? How big must the projectiles—the guns—be? How much powder must I use? I make the calculation. What is this? In order finally to land a paltry 16-pound shot on the moon, no less than eight tons of projectile must be fired! There is no need to calculate the explosive necessary.

A Ray of Hope in the Sky-Rocket

I see that guns within guns will avail me nothing. Moreover, only the last shot, that hopelessly inadequate 16-pound piece of steel, would reach the moon. The rest of the eight tons would come tumbling back to earth with a terrific velocity. Look out for your head!

It is very evident that I cannot reach the moon by the gun route. And, even if it were possible, I would be crushed to a pulp by the terrific impact at the moment of departure.



A machine-gun mounted on a small railway flat-car would be able to kick itself backward, away from its target, by firing a steady stream of bullets. So a sky-rocket might kick itself to the moon

But I am not yet discouraged. A distinguished French aeronautical engineer, Robert Esnault-Pelterie, suggests that I use a sky-rocket. What is it that makes a sky-rocket leave the earth? It is not its reaction upon the air, as many suppose, but rather the recoil from its discharge. A machine-gun mounted on a small railway flat-car would be able to kick itself backward, away from its target, by firing a steady stream of bullets. A sky-rocket might kick itself to the moon.

Some years ago, Rodman Law, the venturesome brother of the famous woman flyer Ruth Law, actually tried to fly with a sky-rocket of huge proportions. His was a successful failure. He did not get very far, but he lived to tell the tale.

Round Trip to the Moon in One Hundred Hours

In a gun the explosive force is applied very suddenly; the blast lasts scarcely 1-100 part of a second, and it deals a crushing blow to the projectile. Esnault-Pelterie calculates that in a sky-rocket big enough to reach the moon the motive force is applied for about twenty-five minutes. In that time an elevation of about 3,600 miles is reached. After that the car travels on by its own momentum without further application of power. This second stage of the journey occupies something over forty-eight hours. If the sky-rocket principle is practical at all, I ought to be able to reach the moon and to come back again in one hundred hours.

How much power does it take? This time I do not have to make the calculation myself. Esnault-Pelterie has already done that. And what does he tell me? No less than 414,000 horsepower are required! This is allowing a weight of about one ton for the car and its contents. The work of carrying me away from the earth's attraction by means of a sky-rocket figures out as nearly 7,000 calories for each pound lifted.

That is quite beyond the possibilities of any known explosive—dynamite, nitroglycerine, or T.N.T. The most terrific compounds used in the great war are not terrific enough to propel even their own weight over the 240,000 miles that must be covered to reach the moon, not to mention my weight, the weight of my food, and the weight of all the machinery in my car.

But there is one substance that does contain sufficient energy for my purpose, and that is radium. Locked up within a few pounds of it is all the energy that I need.

What Happens When Gravitation Ceases to Act?

"What would be the effect upon me if gravity were removed, and removed it would be at a point some thousands of miles away from the moon? . . .

"This is certain: as I approach the moon I will have the sensation of falling headlong through space—a terrifying sensation, which it might be impossible to counteract by the force of the will. . . . In the absence of hand-rails or straps, I should very likely sooner or later find myself sprawling in mid-air, unable to move my body from place to place in the car"

But how can I release it at the rate that I demand? It stubbornly refuses to give out even one half of its energy in less than 2,200 years! If I could hasten the process! Man has harnessed steam, electricity, waterfalls. Can he *unharness* the energy of radium? Some day he will, perhaps, and then a bold man may go sky-rocketing to the moon.

I can picture to myself some of the excitement of that journey, and some of the strange technical problems that must be solved. Being an earthly creature, I must breathe air. Since there is no air between the earth and the moon, with the exception of what little we find in our own atmosphere, I must carry my air with me in the form of compressed oxygen. That will be the least of my difficulties; oxygen-tanks are now an indispensable part of every submarine's equipment.

It will be far more difficult to cope with the cold. Brave explorers have frozen to death in the Arctic and Antarctic wilderness. But the cold that they suffered is as nothing compared with the cold that I must endure. Where there is nothing there can be no temperature. But for practical purposes it is safe to say that the temperature of interstellar space must be several hundred degrees below zero.

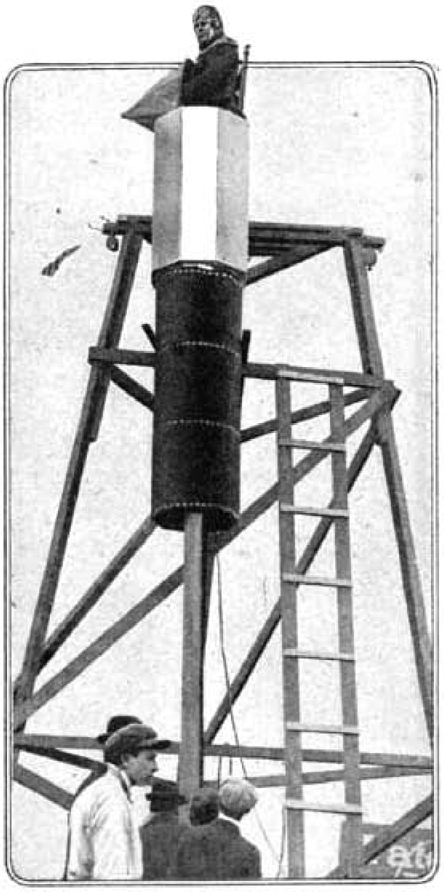
But that is not all. Heat, too, must be overcome—the heat of the sun. It seems paradoxical thus to mention intense cold and intense heat in the same breath. But heat, in this case, manifests itself when the radiant energy of the sun strikes its target. Suppose it were possible for you to stand between two stars. The side that you present to the sun would be exposed to his blaze, the dark side frozen. To maintain a suitable temperature, you will have to provide covers on the shady side to keep in the heat, and absorbing surfaces on the sunny side to absorb all you can. Esnault-Pelterie believes that this object can be attained by providing the car with a proper arrangement of light-absorbing (black) surfaces turned toward the sun and light-reflecting surfaces (mirrors) turned away from the sun.

I seat myself in the sky-rocket car.

How Does It Feel When Gravitation is Removed?

Like every other living organism, man has adapted himself to his environment. Remove me from my environment, and I perish. Without air I cannot breathe. Can I do without gravity? What would be the effect upon me if gravity were removed—and removed it would be at a point a few thousand miles away from the moon?

I cannot walk, or stoop, or write, or lift even so much as an eyelid without being influenced by gravitation. I weigh 150 pounds, which means that gravitation is pulling me down by that amount. Can I safely endure the removal of a force which every moment of my life ceaselessly acts upon me, and to which I have become so accustomed that I no longer heed it?



Rodman Law actually tried to fly with a sky-rocket of huge proportions

For aught I know, the organs of my body—my lungs, my heart—are mysteriously dependent on gravitation. It is certain that they would have developed differently if I were not the plaything of that ever-present force. If gravitation were to cease to act, would this not play havoc with my system? This is certain: As I approach the moon I will have the sensation of falling headlong through space—a terrifying sensation, which it might be impossible to counteract by the force of the will.

Rodman Law's attempt to go up in a sky-rocket was a successful failure. He did not go very far, but he lived to tell the tale

In any case, the ordinary methods of moving about would forsake me. Walking would be impossible. Were the car provided with suitable straps and hand-rails, I could use these to pull myself from place to place. In the absence of such aids, I should be strangely helpless. I should very likely sooner or later find myself sprawling in mid-air, unable to move my body from place to place in the car, having nothing to hold on to, and no gravitation to draw me back to the floor. It is true that if there is air in the car I might propel myself backward by blowing with my mouth, or forward by actually swimming in the air by moving my hands and feet.

Tables, chairs, instruments, tools which were not fastened down would be jumbled in chaotic fashion. The wrench with which I tighten a nut, if I release my grip, would not fall, but hang uncannily in space. It might perhaps be necessary to arrange things so that I should at least have the sensation that gravitation was still acting. This could be done by regulating the speed of the projectile, but only at the expense of much power.

After All, I Belong on the Earth

Lastly, there is the difficulty of stopping this sky-rocket, which has been hurled from the earth with a velocity of over seven miles. Brakes of some kind must be applied. Esnault-Pelterie calculates that in the last four minutes of the journey to the moon the motor must be reversed.

And, when I reach the moon, dare I leave the car and walk about on that airless, dead body—that planetary cinder? Even with a tank of oxygen strapped to my back and with a breathing-mask on my face, I might court death. The moon is cold—bitter cold—cold with the coldness of interplanetary space. May I leave my heated car and brave a temperature low enough to freeze the lightest gas? And the blinding, fiercely glowing sun—I must brave that too; for a man on the moon is exactly in the predicament of a man poised in interplanetary space. There the sun hangs in the sky, a sky not like ours, white and blue, but a terrible sky, jet-black even at midday, a sky pricked even at high noon with the stars that we on the earth see only at night.

I am walking in a land of dazzling high-lights and black shadows. It seems like some impossible nightmare.

One minute on the moon would be so harrowing an experience that I would surely rush back to my car, pull the starting lever of my radium engine, and hurl myself back to earth, where I belong.