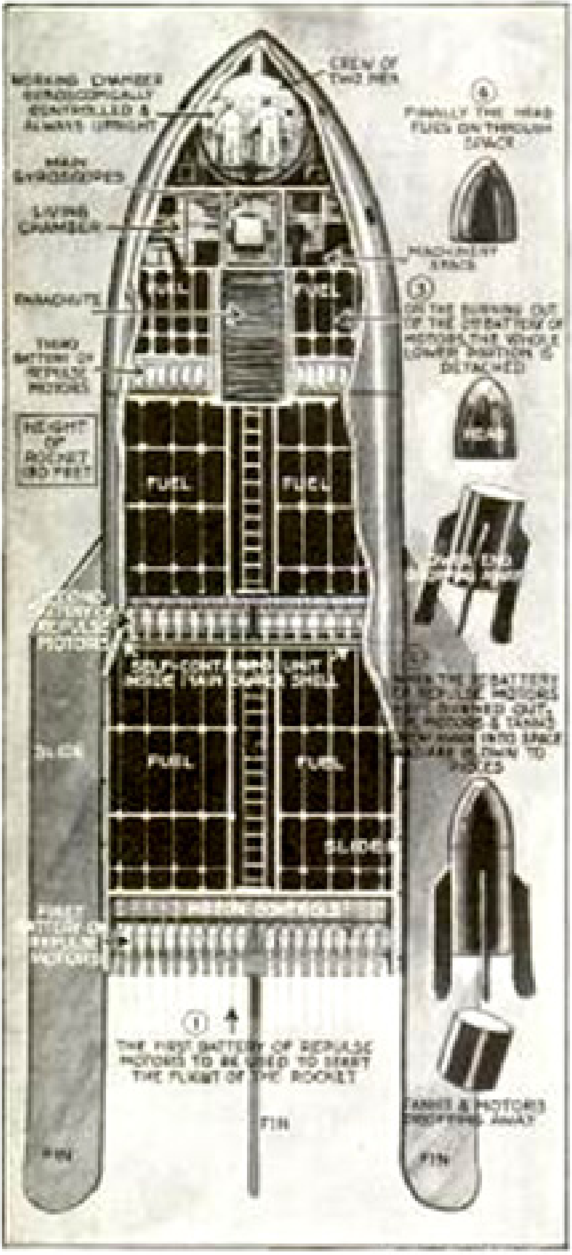
From EUROPE *to* NEW YORK



Drawing by G. H. Davis

Drawing Giving Some Idea of What a Rocket Designed to Carry Two Men to the Moon and Back Would Look Like, as Suggested from Data Known at Present

By G. H. DAVIS

(Special correspondent who recently was commissioned by Popular Mechanics to visit the Raketen Flugplatz, the world's first rocket airdrome ever built, to learn what has been accomplished there.)

ARE we within measurable distance of a rocket post from Europe to America in which special-type rockets will be able to carry a considerable amount of urgent mail and parcel post from Berlin to New York in about twenty-five minutes?

So much has been said about rockets in the last few years, so many extravagant promises have been made for them, that the enormous technical difficulties in the way of developing these new sources of power for useful ends has often been lost sight of. Along with all this talk, fortunately, experiment and research of the most dramatic kind have been in progress. For two years engineers and experimenters all over the world have been endeavoring to master the innumerable obstacles in the way of success, and now their efforts are beginning to bear fruit.

Only last summer the first conquests were made in the long campaign which may lead to the development of mail and freight-carrying rocket projectiles, rocket-powered passenger lines girdling the world, and perhaps even interplanetary exploration. These are the ultimate dreams of practically every worker in this field, and now for the first time they seem to have been brought within the range of possibilities, from an engineering point of view.

These first steps have consisted principally in finding w[illegible] overcome some of the di[illegible] in the use of "liquid ex[illegible] fuels. Ordinary skyrock[illegible] saving rockets, and many [illegible] mental rockets, including

by ROCKET?

Shall We Soon be Sending Mail Across Ocean in Twenty-Five Minutes?

Left, Testing Small Rocket Motor in Metal Container; Below, Experimental Rocket Motor Developing Fifty Horsepower

cently sent to an altitude of six miles by Reinhold Tiling at Wandergog, Germany, are driven by a variety of gunpowders. This composition, burning at a rapid rate, generates the gas pressure necessary to drive the rocket.

But these fuels are useless in large rockets for several reasons. In the first place, there is no simple way to control the speed of burning. An even more serious objection is that dry fuels have been shown by experiment to be too weak for the needs of long-distance rockets. One of the first rocket engineers to call attention to the fact that these difficulties might be overcome by using liquid fuels was Dr. Robert H. Goddard, the great American rocket experimenter. Almost at the same time Prof. Hermann Oberth in Germany, and Robert Esnault-Pelterie in France, published results of their own researches pointing to the same conclusions.

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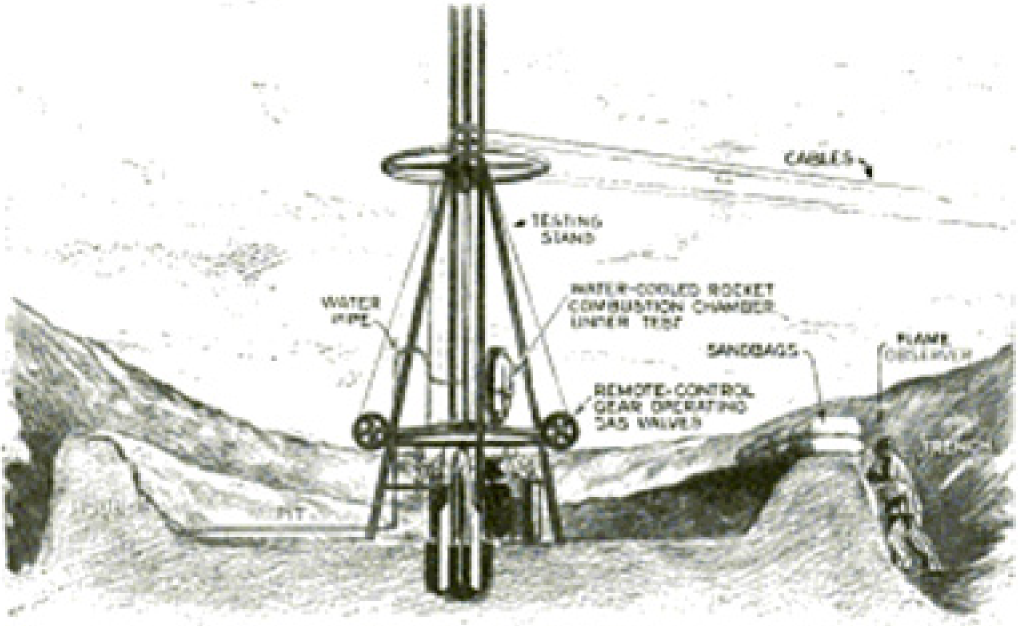
The fuel of a rocket, whether powder or liquid, must burn with extreme rapidity; so fast that, if it were to depend upon the oxygen of the air for combustion, it would not work at all. Pyrotechnic fuels, such as are used in skyrockets, include chemicals which liberate the necessary oxygen during the heat of the explosion. If we use liquid fuels, such as gasoline, we must supply not only the fuel but also the necessary oxygen. Thus one of the liquid fuels must always be liquid oxygen, for obviously the best way to carry oxygen in a rocket is to use it in its liquid state. Liquid oxygen is cranky and dangerous stuff, boiling at the frightfully low temperature of —182 degrees centigrade



Drawing Indicating the Elaborate Precautions That Must Be Taken to Protect Men and Equipment during Rocket Tests in Germany, Owing to Limited Knowledge of What May Happen

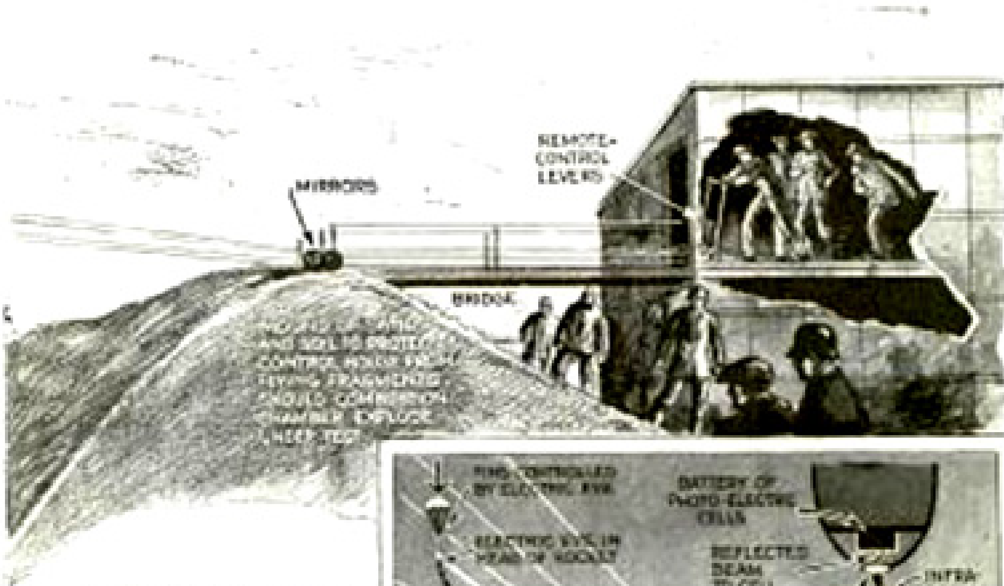
and exploding violently from its own gas pressure if confined in a tank at ordinary room temperatures. Consequently there is a serious problem in the control of this volatile fuel under the conditions present in a rocket, where the temperature in the oxygen tank is about —185° and in the combustion chamber, only a few inches away, that of an oxyacetylene flame.

Another problem is how to get the liquid fuels into the combustion chamber of the rocket against the frightful heat and explosion pressure there. The fuels must, of course, be introduced rapidly and steadily to keep the reaction pressure steady. This calls for some kind of pumping apparatus, yet any type of mechanical pump would add greatly to the weight of the rocket—perhaps so much as to overcome the advantage of liquid fuels over dry fuels.

Finally, the change to liquid fuels brings up innumerable questions relating to the rocket motor itself. What is the best shape? What materials must be used to withstand at the same time high pressure and intense heat? How can the motor be kept cool to prevent melting or bursting? At what points and in what direction may the fuels be introduced, and in what proportions? Finally, what should be the shape of the nozzle, and how long should it be? These problems are still not completely solved, though engineers are now working on liquid-fuel rockets in at least seven countries.

The first liquid-fuel rocket ever to fly is believed to have been shot by Doctor Goddard near Worcester, Mass., on July 17, 1929. This rocket, burning oxygen and a hydrocarbon fuel, the exact nature of which has never been revealed, made a successful flight and landed by parachute. But its performance has since been so far surpassed by the German rockets that the credit for solving the major problems of fuel pumping and control must apparently be given to the engineers of the Raketen Flugplatz, or rocket-flying field, at Berlin.

This field is the property of the Verein fur Raumschiffahrt, or German Interplanetary society. The thousand or more members of this society support the work at the flying field, and six full-time engineers are employed, under the direction of Rudolf Nebel and his assistant, Klaus Reidel,



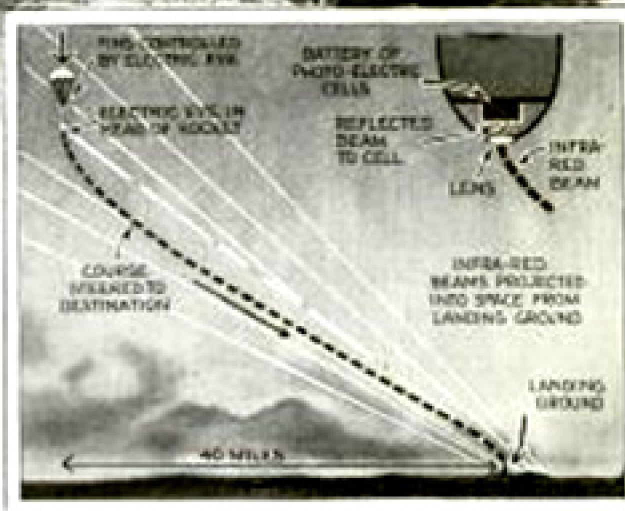


Diagram Showing How It Is Proposed to Use the Electric Eye, or Photo-Electric Cell, to Steer a Rocket to Its Destination

As might have been expected, it was at the Raketen Flugplatz that many of the major advances in harnessing liquid fuels to rockets were made.

It has certainly been demonstrated that liquid-fuel rockets can be built and will fly, and also that the efficiency of the rocket motor, when properly constructed, is very great.

The motor used by the Germans in their experiments is actually only about the size of an egg, and somewhat the same shape, with a nozzle about two and a half inches long. The whole apparatus may be concealed in the hand. Built of duralumin, it weighs somewhat less than half a pound. Yet it will deliver a lift of over thirty pounds, and is capable of hurling a fifteen-pound rocket nearly fifty miles into the air in one minute if ...fficient fuel is provided to keep com- ...ing so long.

... of the Raketen Flugplatz ...ket, capable of ... twenty- ...t the ...ra-

chute to bring the whole apparatus down safely. This rocket will have three motors, each about eighteen inches in length, and each capable of lifting 180 pounds. It will be possible to build a rocket weighing about a quarter of a ton, which will have an acceleration of about thirty-two feet per second and a range of many miles, depending upon the amount and type of fuel carried.

The next problem to be solved in rocketry is the difficult one of flight control. It is now mechanically possible to build a rocket capable of crossing the ocean, but as yet we have no apparatus which will guarantee that it would land where di-

© Pendray

rected. Some kind of light, efficient and automatic steering device must be invented which will control the rocket in flight and bring it down at the proper point. To date, almost no experimental work has been done on this angle of the problem, because the first task obviously was that of constructing a liquid-fuel rocket which would fly at all.

So far the European engineers have made the greatest strides in solving the rocket problem, but we may confidently expect that the next great advances will be made by Americans. Already experiments are being carried on in the United States in at least four widely separated places. Doctor Goddard is working silently at his laboratory in New Mexico, aided by a fund of $100,000 made available to him by the late Simon Guggenheim. In San Francisco, another member of the American Interplanetary society, Cleve Shaffer, is building his fourth experimental rocket motor. A third experimenter is Harry W. Bull, of Syracuse, N. Y., who is carrying on his work in the laboratory of the University of Syracuse, and will soon build a rocket to test important theories of his own in relation to flight stability and control. A fourth experimental project is that of the American Interplanetary society, near New York City, where a rocket is now being built under the direction of Edward Pendray, David Lasser and H. F. Pierce. Dr. H. H. Sheldon, of New York University, is also aiding with this project.

At any one of these four points of experimentation the important idea may be developed which will lead to positive control of rockets in flight. When this has been accomplished, it is only a matter of time until the stratosphere will be explored by rocket projectiles, and until rockets will be flying from city to city and across the ocean, bearing mail, express and even passengers. When these objec-

Above, Copper Lining of a Small Rocket Motor; Below, Pouring Liquid Oxygen into a Test-Stand Tank

tives have been reached, the next step will be the problem of sending a rocket out into space, to the moon or to another

It is well known that to esc
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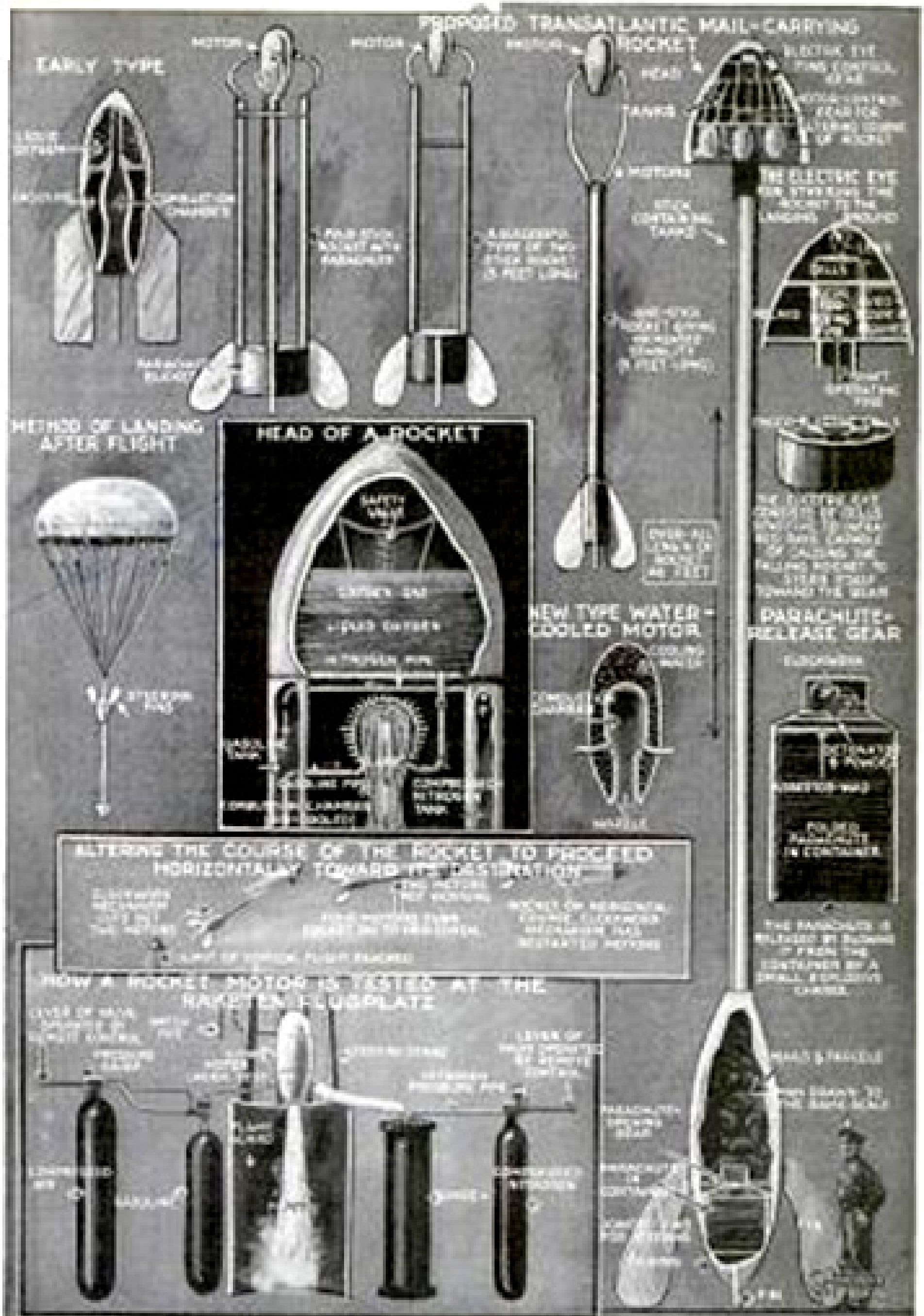


Some of the Earlier Types of Rockets That Have Been Used Successfully as Compared with the Proposed Transatlantic-Mail Rocket; Note Parachute-Release Gear vehicle would also not only have to lift itself away from the earth, but also have sufficient energy to continue to combat the earth's pull, a pull that continues—with diminishing intensity 'tis true—to infinity. Therefore it will be seen that the propellant must be of enormous power-for-weight to lift the rocket through the atmospheric belt into free space.

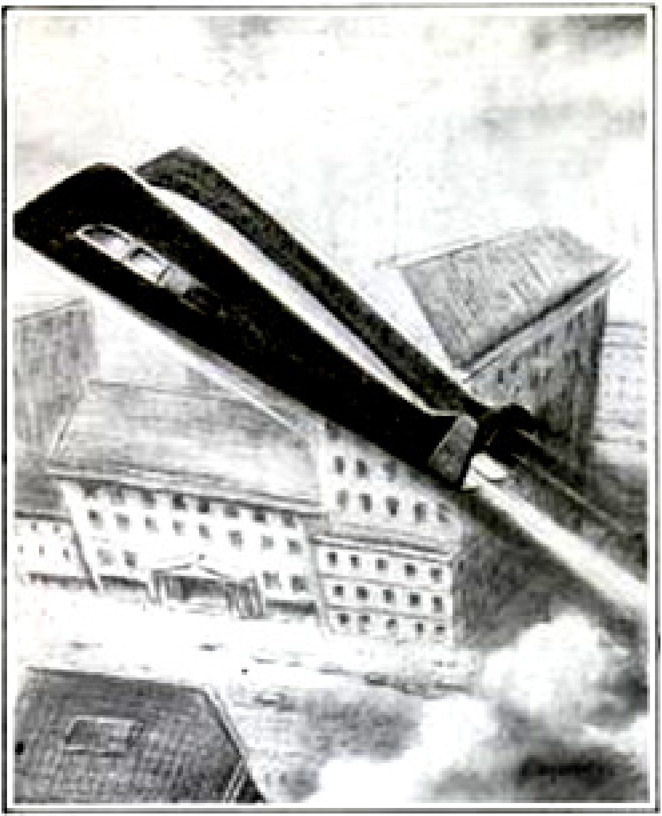
It has been figured that a flight across the Atlantic would require a rocket forty-six feet in length, driven by at least half a dozen motors and that it must climb right up through the atmospheric belt to a height of 300 miles. So definite are the scientists in the accuracy of their calculations that they claim there will be not more than a fifty-mile error at the end of the flight; that is, the rocket will be within fifty miles of its destination should it be allowed to fall directly to earth.

But to get over this error efforts are being made to perfect gear for guiding the rocket "home." Scientific people in Berlin have now constructed photo-electric cells sensitive to infra-red rays. Experiments are being made to project the rays to considerable distances and guide the falling rocket to its point of destination by means of an "electric eye" in the head of the rocket.

To arrest the free fall of the rocket, a special type of parachute has up to the present been found to be the most satisfactory fitment, though vanes somewhat like those of an "Autogiro" airplane have been tested.

It may to us seem inconceivable that man will ever fly, at a speed undreamed of today, vast distance through space, for the moon is a minimum distance of 240,000 miles away, Mars 50,000,000 miles and Venus 26,000,000 miles distant from the earth. But what would our grandparents have thought if someone had told them that man would be flying at 400 miles an hour in 1931 and others talking across the world by wireless telephony, or using the hundred and one other scientific wonders that are just everyday playthings of today.

These people of the rocket science, not only the German enthusiasts at the Raketen Flugplatz, but many men in other parts of the world, are not just dreamers, they are skilled scientists and engineers who are helping forward the progress of the human race, and that is all there is to it.



Design for a Rocket Plane Intended for a Trip to the Stratosphere; Note Unusual Streamline Treatment and the Odd Sides

TAIL WOULD HELP LIFT PLANE PROPELLED BY ROCKETS

Rockets are to furnish the power for an airplane designed by a German engineer for a flight to the stratosphere, but the rockets will not do all the lifting of this artificial comet. Instead, the whole tail is developed as a lifting surface which is expected to enable the ship to pull itself up by its own boot straps. The absence of propellers, the streamlining and the odd sides give the design a decidedly unusual appearance.

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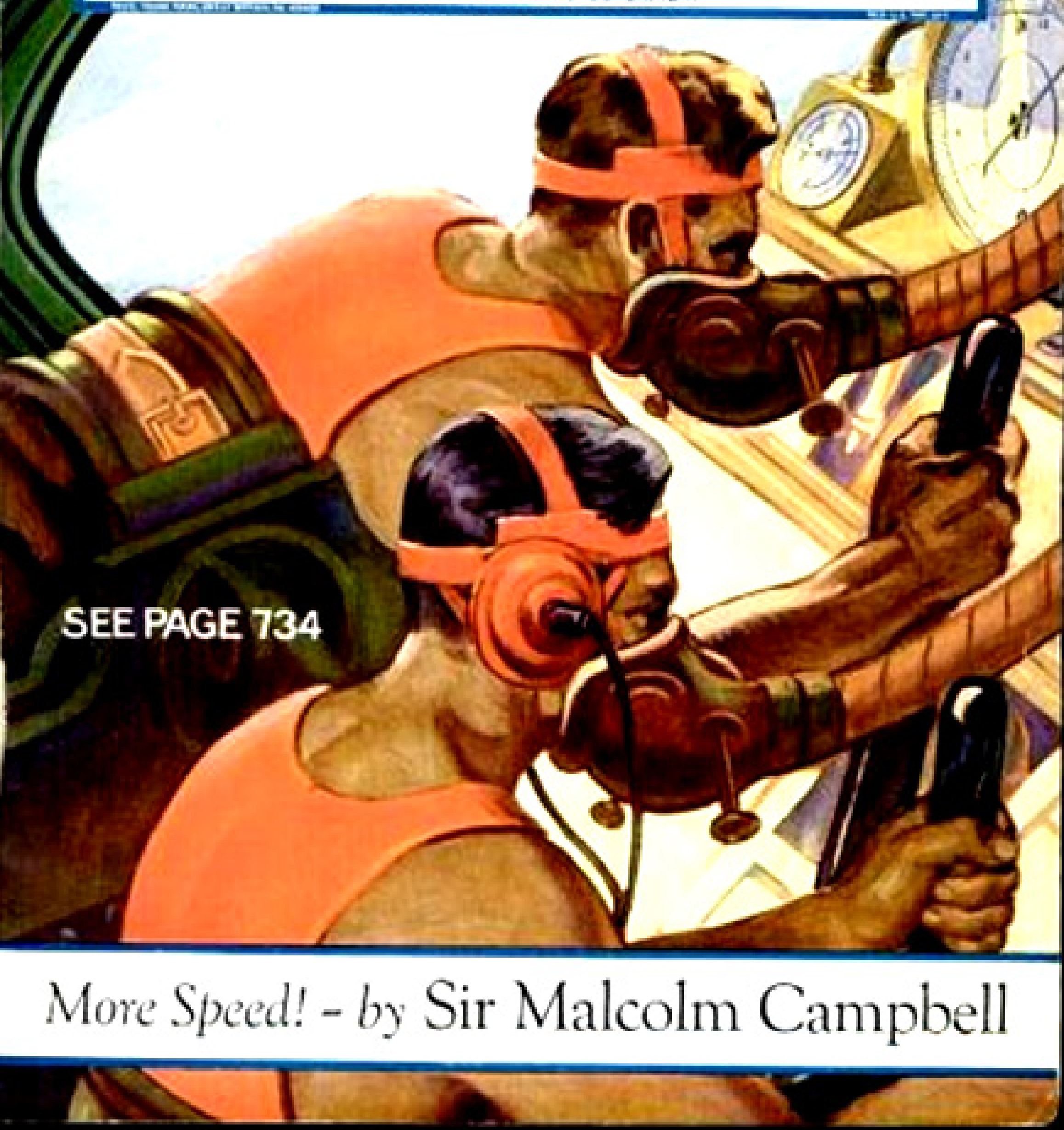

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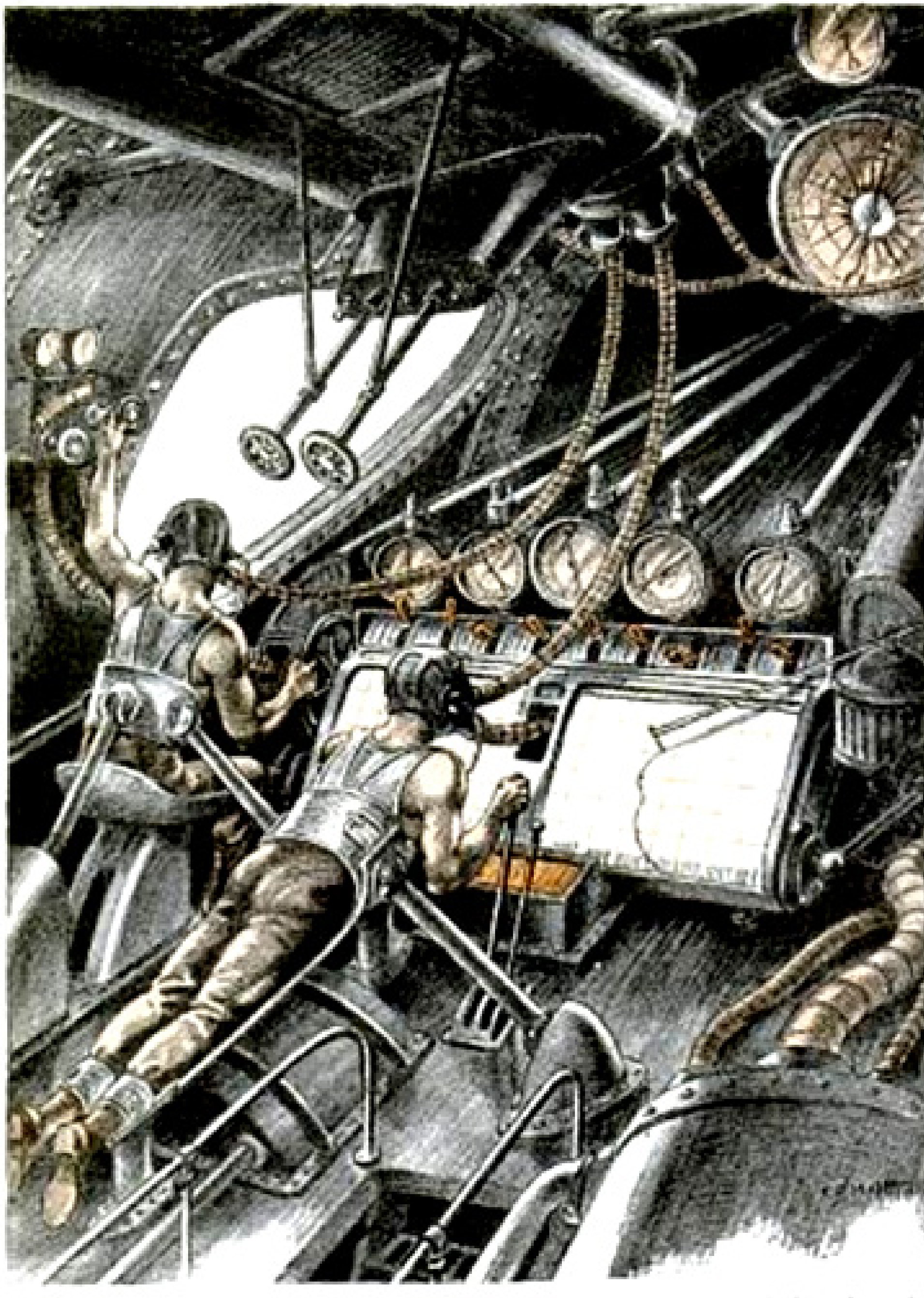
More Speed! – *by* Sir Malcolm Campbell

At the Controls of an Aircraft of the Future



An Artist's Conception of the Way Rockets Will Be Guided in Their Flights through Space by Pilots Strapped in a Sealed Compartment

MAN-CARRYING ROCKET SHIPS PRESENT MANY PROBLEMS

Rocket-propelled airships of the future may resemble present-day Zeppelins, except that they will be equipped with stubby wings that telescope into the sides of the craft when not needed. Ships big enough to carry passengers still present many problems, but those experimenting with such a form of travel are already speculating on the construction and operation of the craft when they do make their appearance. Some German inventors believe these ships will be catapulted into the air as is now done with airplanes, and will ascend at the start with the aid of short wings. Upon reaching the stratosphere, the wings might be withdrawn into the hull after which rockets alone would provide the power. In leaving the earth, the speed of the craft would be held down because the occupants would be unable to withstand the tremendous pressure, but at a height of about 600 miles, the ship might be expected to attain its full speed, estimated at 250 miles a minute, a journey from Paris to Chicago requiring fifteen minutes at such a rate. The crew of a rocket ship of this sort would be strapped in places in an air-tight compartment with its own oxygen and heating plant. At a speed of 250 miles a minute, or 15,000 miles an hour, landing would present as much of a problem

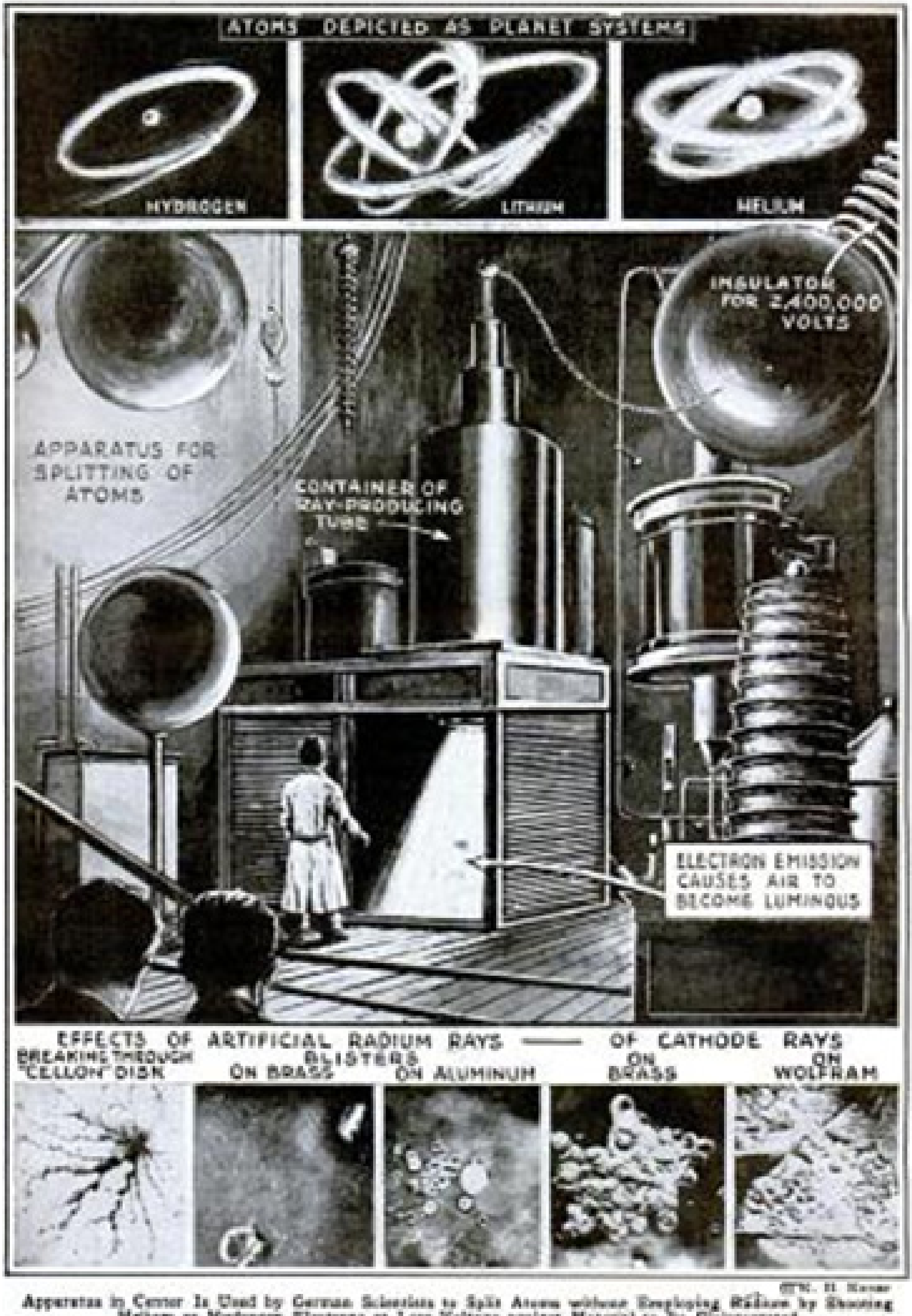
Rocket Propelled by Liquid Gas and Intended for a Trip to the Stratosphere; the Missile Carries an Altimeter and a Parachute to Be Used in Descending

LIQUID GAS TO PROPEL ROCKET ON STRATOSPHERE FLIGHT

Liquid gas, instead of powder, is to be used to propel a large rocket made by Herr Winkler, noted German engineer and intended for a flight to the stratosphere. It is estimated the explosion of the liquid fuel will last for forty seconds and will send the rocket upward at a speed of 265 miles per minute. At the head of the missile is an altimeter with a parachute attached which opens as the rocket descends.

Delivering more than mail.....

Splitting Atoms with Artificial Radium Rays



Apparatus in Center Is Used by German Scientists to Split Atoms without Employing Radium by Shooting Helium or Hydrogen Electrons at Low Voltage against Material to Be Disintegrated

ATOMS SPLIT IN VACUUM TUBE WITH BOTTLED ENERGY

Two German scientists, Dr. Lange and Dr. Brach, have succeeded in splitting atoms by employing artificial radium rays. The procedure includes shooting helium or hydrogen electron streams of great velocity at comparatively low voltages against the material to be disintegrated. By this method they have disintegrated the elements lithium, beryllium, borium, sodium and aluminum, which have light atoms, and also lead, which is of high atomic weight. The energy of radium itself could not be used because enough of the element is not available, but its various rays, alpha, beta and gamma, were created artificially by sending an electric current of very small amperage through a vacuum tube containing helium or hydrogen gas, the electronic velocity being considerably increased by using voltages from 500,000 to 2,400,000. The same men previously attempted to collect atmospheric electricity of 8,000,000 to 10,000,000 volts with an installation extending between two peaks in the Alps, and at present another apparatus is being built which they hope will put at their disposal from 7,000,000 to 10,000,000 volts.