# The Moon?

## Experiments with Projectile He Would Reach Satellite

(Continued from Preceding Page)

transfer of the water to the land surfaces in the form of snow.

At length was reached a stage where, for lack of winds that had any carrying power, the water evaporated by the sun of the lunar Summers was deposited as snow immediately around and along the banks of the seas and other water spaces, instead of being borne afar.

Thus, in the course of time, hundreds of thousands of years probably, were formed the tremendous cliffs, thousands of feet high, which wall the so-called craters.

Once upon a time every such crater was a lake or pool of water. It might be said that pools and lakes are not usually circular. Neither are the craters on the moon. As already stated, they are of all kinds of shapes.

The modern high power telescope gave us our first opportunity really to study the moon. The earliest observers perceived on its surface large drab-hued splotches which they supposed to be seas. We now know that they are vast plains.

But they are plains surrounded by precipitous and lofty walls. They are, in fact, mere "craters" of enormous size.

Once upon a time they really were seas. They are ancient bowls from which the water has taken flight in the form of white flakes settling upon the dry surface of the land. They were shallower than our oceans, averaging not more than half a mile in depth.

The seas were the main source of snow supply, and hence the most enormous craters are the former sea-basins. And around their borders on all sides, therefore, stand high walls of snow, some of them very precipitous on their inward faces, but in all cases sloping off gradually on the outside toward the general surface of the moon.

During each lunar Summer, with its fortnight of continuous warm sunshine, a good deal of the snow melts and the water seeps back into the basins. Having done so, it again undergoes the process of evaporation, and, because there is no wind to carry the snowflakes (into which the vapor is converted a few days later), most of the snow remains to restore and heighten the old surrounding walls.

One thing that has puzzled astronomers is why the hugest mountains and mountain ranges rise in the relatively featureless plains, where craters are fewest. It is a matter of easy explanation.

When those great walled plains were occupied by seas—in other words, when the lunar oceans were full—islands doubtless rose here and there above the surface of the water. Situated as these islands were in the very heart of the principal snow-producing districts, they naturally accumulated, by the process already described, immense loads of snow. They were crowned, in the course of ages, by heaps of ice and snow which now tower thousands of feet, even miles, toward the sky.

In this way, on a long island, was formed the great lunar range known as the Apennines, which, extending for a distance of 450 miles, contain no fewer than 3,000 peaks, one of which, Mount Huyghens, attains an altitude of three and a half miles. That range is built, at least mainly, of snow and ice.

The same may be said of another important range, the lunar Alps, which has 700 peaked mountains, and is remarkable for a tremendous valley 184 miles long and five miles broad. Much of its heaped-up ice and snow doubtless came from this trough, originally the bed of a mighty river, or perhaps a long arm of the sea.

Similarly, the lunar Apennines Valley is merely the vacant trough of a sound which anciently separated the above-mentioned long island from the mainland.

Imagine the long and narrow island of Cuba to undergo such rapid seasonal changes as occur on the moon. Suppose, further, that snows from one brief Winter to another should keep on accumulating until they were piled miles high. What a wonderful "mountain range" it would make, and how like the lunar Apennines!

Fancy some strange freak of nature by which all the waters of our oceans, lakes and rivers should be converted into snow and settle upon our continents and islands, never to return again to their ancient beds. What a weird and wonderful spectacle our planet would present!

This is exactly what has happened on the moon. It is why her surface is so magnificently and so strangely sculptured. It is why we see no rain clouds upon her; why her atmosphere has disappeared, buried in the snow.

Why has not the same thing come to pass on frigid Mars? Because that planet revolves in front of the sun every twenty-four hours (or about that), as the earth does. It has therefore no seasonal alternations like those of the moon.

It will be understood, then, how, on the moon, deep ponds have become cavernous craters, islands have grown into mountains and mountain ranges, rivers have erected their level banks into precipitous gorges, and great lakes have disguised themselves as walled plains. All of these remarkable features are the work of Jack Frost.

The craters, which from our viewpoint bear an undeniable resemblance to the mouths of terrestrial volcanoes, are thousands in number. On our planet the largest volcanic crater is that of Haleakla, in Hawaii, which is seven miles in diameter. But some of the lunar craters are over 100 miles in diameter, and from that size they range down to small ones hardly discernible through the best telescope.

The above statement of maximum size, be it understood, does not take into account the great plains, formerly sea beds, which, as already said, are themselves vast craters surrounded by lofty cliff-walls.

Every one of the craters has its encircling wall, in some cases four or five miles high. The deep ones have bottoms (often level as a floor) much below the general level of the moon's surface. It is as if a giant had dug a well and piled the excavated material around the brim. Often the inner face of the wall is so precipitous as to be almost vertical; but, no matter how steep this inner face, the outward slope away from the crater's mouth is invariably a long and gradual slant.

The most interesting craters present the aspect of immense walled amphitheatres. Scattered over the floors of some of them are smaller craters, and in many instances tall mountains shaped like gigantic sugar-loaves rise from the level plain which the cliff-wall encompasses.

This latter feature has been particularly puzzling to astronomers, who have been at a loss to hit upon any plausible explanation. But the moment that the idea of snow-transfer is grasped both the sugar-loaf mountains and the subsidiary craters are easily accounted for.

Suppose the original existence of a lake. Its disappearance, through evaporation and transfer to the land in the form of snow, was gradual. As the process continued the surface level of its water lowered, bringing into view here and there elevations of the bottom which, emerging, became islands. As soon as these elevations became dry land they began to accumulate snow, and, being most favorably situated for that purpose in the midst of a large snow-producing area, they gathered snow with a maximum rapidity. And in the course of time the snow was bound to assume upon them the form of lofty towars, veritable icy mountains, of a more or less sugar-loaf pattern.

So much for the sugar-loaves. Now suppose (as must have happened) the evaporation to continue until the bed of the lake was almost dry. There would still be pits here and there, depressions, containing water. As evaporation went on, slowly drying up this residue of water, snow would be deposited around the edges of the pits. The process, exactly the same as that already described, would convert these pits into lesser walled craters—exactly such minor craters as are scattered over the floors of many of the big craters on the moon.

It might be said that every dent in the moon's surface that anciently contained water has become a crater by the conversion of its fluid contents into snowflakes and the settling of the latter on its brim. Hence there is no reason to be surprised at the extraordinary number of craters seen on the lunar landscape.

The telescope can discern on the moon an object the size of a city block, but nothing smaller than that. We can, therefore, see only craters that are of considerable size. Probably there are mutitudes of lesser ones too small to be distinguished.

It is noticeable that the floors of many lunar craters are deep below the level of the normal surface of the moon, whereas those of terrestrial volcanic mouths are invariably much higher. And the deeper the crater the higher are the walls encircling it—because the water in the original lake or pool was deeper, supplying more vapor to make snow, which, with no winds to scatter it, settled on the encompassing walls and added progressively to their height.

Notwithstanding what has been said, the atmosphere of the moon has not wholly departed. There is still some of it left, though it must be extremely thin. What there is of it can carry moisture. Professor Pickering, the famous Harvard astronomer, has written of clouds of vapor—fog or mist—which he has seen sweeping across the vast plains called "seas." On one occasion he saw the lunar ridge of Teneriffe "steaming from end to end."

Other astronomers, observing these strange occurrences, have attributed them to "noxious gases escaping from volcanic vents."

The crater called Mosting A is five miles in diameter and 3,000 feet deep, with a floor of brilliant whiteness. But with the arrival of the lunar Summer a dark spot appears on the floor, growing in size to a breadth of about a mile. There are other large craters in which at the same seasonal period similar spots are observed, which disappear with the oncoming of the lunar Winters.

Very curious. What may we suppose these spots to be? The answer is easy. They are water from the melting of the encircling snow walls of the craters—water that seeps down to the lowest level in the middle of the crater and forms a pool.

Large areas of the great plains called "seas" darken with the advance of each lunar Summer, but resume their normal lighter color in the lunar Autumn. Water again, from melted snows.

The spots in the craters and the dark areas on the plains disappear in the way described because the water is evaporated by the sun, to be thereupon converted into snowflakes and redeposited on the dry surfaces of the moon. Some of the snow, of course, falls into the water; but the water-covered areas steadily shrink, leaving more and more of the surface bare until all of it is dry. The snow has no chance to accumulate in any quantity on those areas, and what does remain is quickly melted and evaporated in the early lunar Spring.

The atmosphere of the moon is so thin that water on that orb may be supposed to boil at about 40 degrees Fahrenheit, and evaporation must be rapid at a point not much above freezing. The mists of vapor observed by Pickering and others are doubtless produced by the evaporation of the temporary pools.

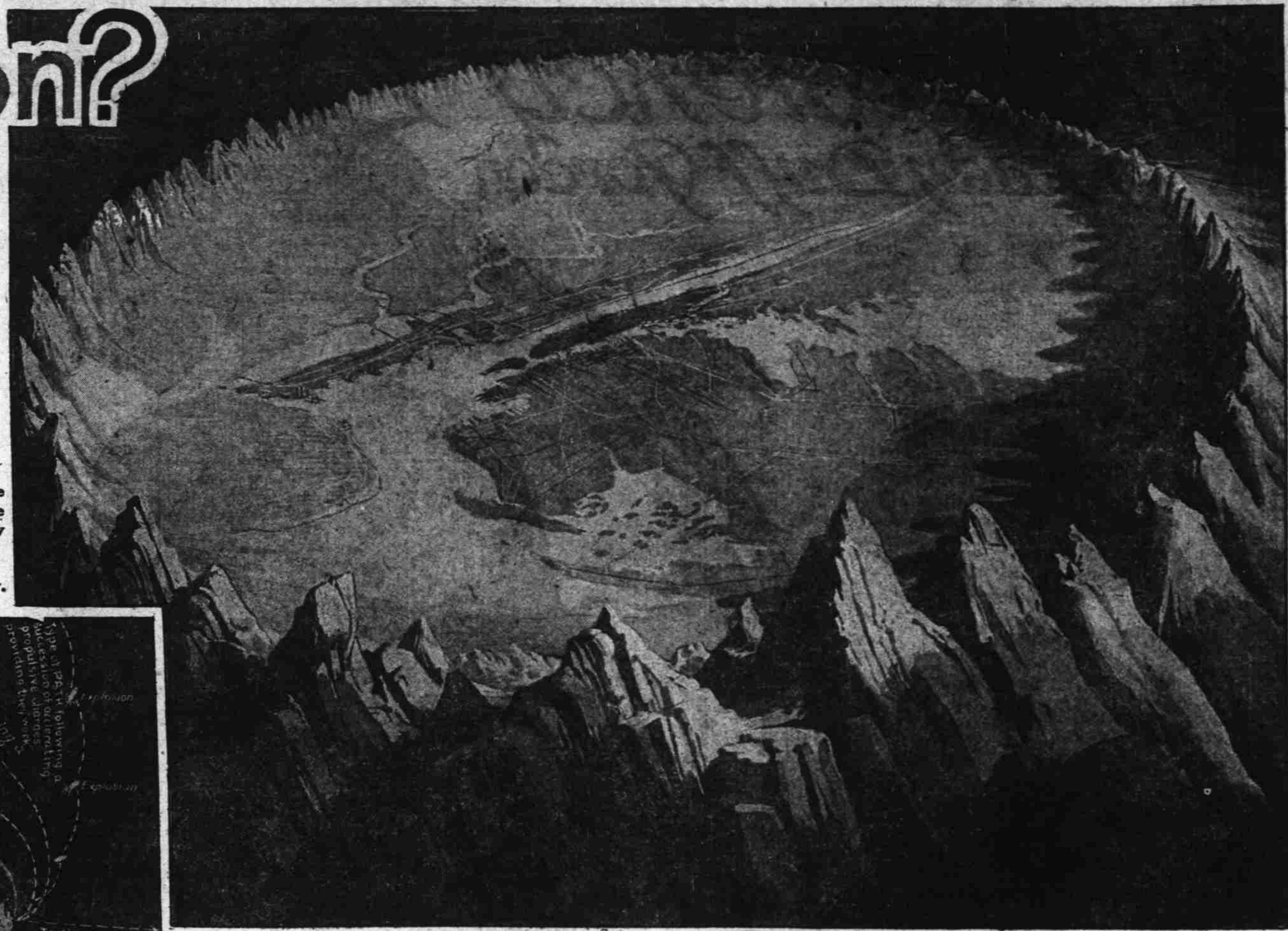
For the production of snow on the moon we do not need to imagine clouds. Nansen and other explorers have testified that in Arctic latitudes the transformation of atmospheric vapor into snow is accomplished directly and without clouds. In those regions a fine dusty snow is often precipitated from the air when the sky is cloudless.

It is interesting in this connection to quote Professor Russell W. Porter, who writes: "Having spent many years above the Arctic Circle, I was struck by the strange likeness of the moon's general aspect to our own polar regions. The long reaches of the frozen polar ocean, traversed by immense ridges and cracks, the dazzling whiteness and clear-cut shadows, the desolation and loneliness—all seemed to find a counterpart in the lunar landscape."

Professor Goddard's project of communicating with the moon opens up the interesting possibility that more of its atmosphere may be liberated from the snows and our satellite thus made habitable.

It would not be possible absolutely to verify the ideas here set forth without making a journey to the moon, landing upon its surface and examining it.

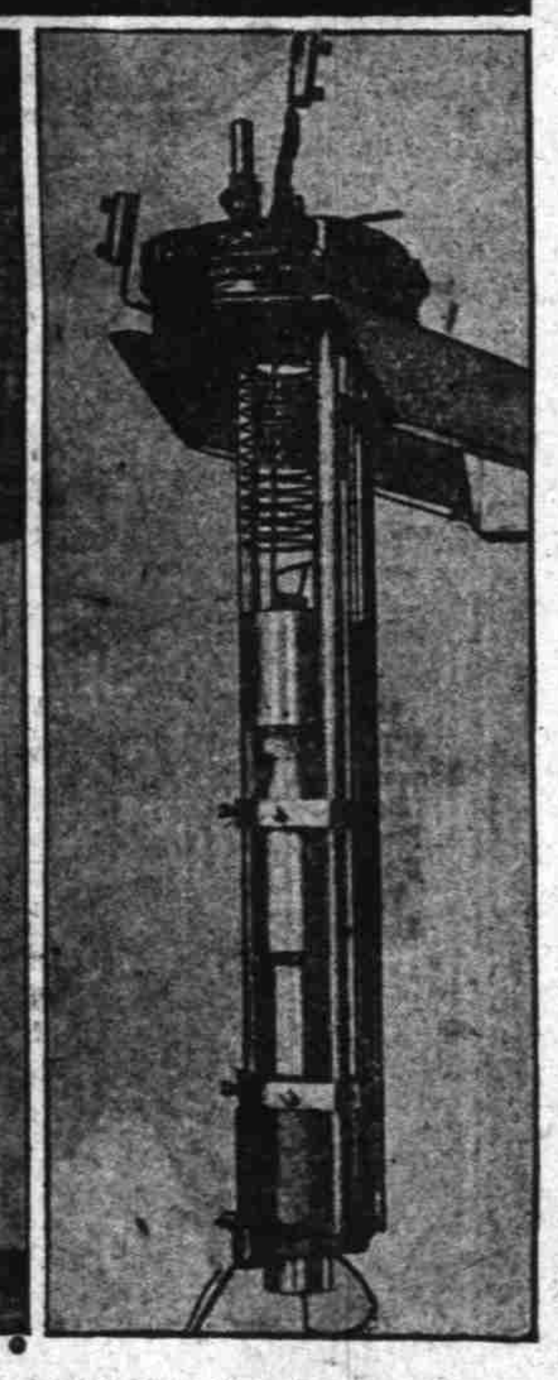
If the moon can some day be reached by a rocket, as Professor Goddard suggests, it will be the most momentous achievement of science. When the national Government wastes countless millions every year and people give blindly to such dubious things as the Red Cross it will be strange if the necessary funds cannot be found to finance Professor Goddard's interesting experiment.



A Remarkable Reconstruction of an Immense Crater on the Moon Called Ptolemaeus. So Large Is This Indentation That All of Manhattan Island, Brooklyn, Jersey City and Many Hundreds of Square Miles of New Jersey and New York Could Nestle in It With Ease, as the Accurate Relief Map Within the Walls Show.
*By Courtesy of the Bray Pictures Corporation, New York.*

Suggestions of the Various Paths the Moon Rocket May Follow on Its Journey, According to Its Velocity.


Professor R. H. Goddard, Assistant Professor of Physics at Clark University, Massachusetts, and the Vacuum Pipe in Which He Tests with a Small Model of His Apparatus the Conditions Which His Rocket Would Have to Encounter on Its Way to the Moon.



A Model of Professor Goddard's Projected Moon Rocket With Which He Has Been Experimenting.

While Professor Goddard does not admit that he contemplates sending human passengers to the moon at present, because that might raise too sanguine expectations, the theory of his invention makes that achievement possible, and it is evident that that is the ultimate object of his plans. In that case the fantastic adventure described in Jules Verne's "Trip to the Moon" would become a reality, as so many of the other imaginative visions of the great scientific novelist have done.

All the details have been thought out for making the moon rocket a comfortable vehicle for passengers. She would have a powerful double steel envelope, with vacuum chamber to compensate for the changes in atmospheric surroundings.

Oxygen would be furnished by a tank within the machine as in submarines.

Professor Goddard's skyrocket was recognized as an implement of great military possibilities during the war and would have been used if hostilities had continued a few months longer. The rocket as designed was capable of remaining in the air for a flight of 200 miles and could have been employed to cause very destructive and demoralizing effects behind the enemy's lines.

In order to obtain valuable results from sending the rocket to the moon it would be necessary that competent scientists should make the trip and take photographs. Whether they could go on a tour of exploration on the moon's surface appears to be a separate problem, as an air satellite is believed to have no atmosphere capable of supporting life. In that case, it would be necessary to make special vehicles in which the scientists could travel about the moon.

Even the preliminary dispatch of a rocket to the moon without a human passenger would be an occurrence of great interest and scientific value. It would prove the possibility of sending men there.

It should not be difficult to record the arrival of the rocket on the moon's surface. With our most powerful telescopes the moon is now brought within an apparent distance of fifty miles of the earth. An object 500 feet in length would be readily visible at that distance.

The rocket would be designed to discharge a heavy explosion of black smoke upon striking the moon's surface. This ought to be seen and reported by such telescopes as the one at Mount Wilson and several others.