Exploring by Airplane

Some Opinions on the Possibilities of Winged Exploration Parties of the Near Future

By Eric A. Dime

SINCE the great world war came to an end, there has been some speculation as to the new field in which the flying machine may play an important part. The airplane has demonstrated its usefulness in the European conflict that crushed the power of the Kaiser, making the world safe for democracy, and it is but natural to assume that this vehicle of the air has more glories awaiting it in the peaceful pursuits of life.

In fact, the airplane is already used for commercial purposes. As a carrier of mail between Washington, Philadelphia and New York, it has proved a success, and this service will no doubt be extended to other points in the United States. We also believe that many of the machines which have been manufactured for the government during the war will be used for passenger and freight carrying purposes. Commuting through the air may prove a common sight in the near future.

There is still another big field open to the winged chariot of the skies, which can overcome obstacles that have proved an impediment to the ordinary ways of travel on land and water. It is the field of exploration work—the bringing of man into those unknown regions of the earth for the study of nature and animal life. The long range of sustained flight and high altitude, of which our airplanes are capable, should make these machines extremely valuable to the explorer, the naturalist, and the hunter who wander into the wilderness in quest of something that would benefit science and the human race.

That some of these men are seriously considering the airplane in exploration work may be known from the fact that Capt. Robert A. Bartlett, who accompanied Rear-Admiral Peary on his trip to the Pole, has decided to employ the flying machine on his proposed Roosevelt Memorial Expedition, which he will lead next June to make an aerial survey of the North Pole.

Turning our attention to Africa, South America and other countries with unexplored territory, I believe the time is near at hand when expeditions equipped with flying craft will venture into regions which so far have never been seen by civilized man. From interviews I have had recently with men, who are familiar with exploration work, I have gained sufficient information to believe in the practicability of the airplane in this field. Of course, there may be some drawbacks to such a venture; the country to be explored would determine the success of the undertaking. Furthermore, a machine used for this work would necessarily have to be of a design different from the military type, or the aircraft used for passenger and commercial purposes. This would be the case in exploring jungles or deep forests, broken by high mountains, for which Africa and South America are known.

Carl E. Akeley, known as one of the most famous taxidermists and sculptors in the United States, who has charge of the African Hall in the Museum of Natural History, New York, is placing great faith in the airplane for exploration work. Mr. Akeley is the inventor of the Akeley Camera, which has been used with excellent results by American photographers near the front line trenches during the war. He is also an explorer and he plans a trip at the end of this year to Africa in the interest of science. During a discussion I recently had with Mr. Akeley he said that there are still great fields open for exploration, especially in South America, Africa, Madagascar, Asia, New Zealand, and islands in the Pacific Ocean. The reason why so little is known about those regions is greatly due to the difficulty of getting into the interior with the ordinary means of travel.

Mr. Akeley believes that it would be possible to fly into the country to be explored and locate a suitable landing place. Then it would be a matter of studying the country, its natives and animal life in the immediate neighborhood. It would no doubt be better if a group, or squadron of planes, could make the trip, as it might prove too risky for a single machine to set out into the unknown. The explorer-aviator might find it difficult to locate a suitable landing, due to dense forests, but I understand that in some regions like Central Africa there are wide open spaces with short grass that should prove ideal as an airplane's landing and starting point.

During a lecture recently delivered before members of the Aeronautical Society, Mr. William Beebe, of the New York Zoölogical Society, spoke on "South America and the Airplane." He illustrated his speech with lantern slides showing photos of forests taken from airplanes. The pictures were from the battlefields of France but Mr. Beebe used them merely to describe what might be done in South America with an aircraft camera. In his lecture he said among other things that some interesting sights could be seen by flying over the vast forests of South America. "The man who travels on the ground," said the lecturer, "has no idea of the beautiful scene which the crowns of trees in the dense forests present to the aviator. Such a study of a forest with its bird-life ought to tempt many an aviator to take a trip that would prove fascinating while at the same time a little risky and dangerous.

"The airplane should prove a valuable factor in the mapping of a country, and this could be done with a mapping camera. The photographer could soar over the gigantic forests and rivers of which we today know little or nothing. Every large river and its tributaries in South America could thus be recorded for our geographical records."

It might be stated in this connection that a mapping camera, designed for airplanes, has been invented. It is called the Brock Automatic Camera and is suspended from the fuselage of the machine. It is so pivoted that

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Correspondence

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The Canal Street Hudson River Tunnel

To the Editor of the SCIENTIFIC AMERICAN:

The meeting of the American Society of Civil Engineers held on the evening of the 19th of March, was one of the most interesting that the writer has ever attended. The paper presented was by Mr. Austin T. Byrne on the proposed traffic tunnel under the Hudson River at Canal Street from Manhattan to Jersey, with especial reference to the plan approved by Gen. Geo. W. Goethals and on the plan of execution as proposed by Jno. F. O'Rourke the noted foundation expert and tunnel builder.

The need of such a tunnel, or an equivalent method of carrying the highway traffic from Manhattan across the Hudson, is conceded by all persons and by all engineers that have studied the problem, and I am sure after listening to the discussion of the paper, that all of these present at the meeting were not opposed to the building of a tunnel; but as Mr. Forgie expressed it, they "hae their doots" about the methods proposed, and, to some extent, about the ventilation of such a bore to carry automobile traffic after it is built. There can be no doubt, after the masterly analysis made by Mr. Byrne of the amount of traffic that such a passageway would have available to carry upon its completion, as to the need for haste in doing something to relieve the traffic barrier that now exists.

The discussions by Mr. Jno. V. Davies and by Mr. James Forgie, the noted tunnel expert, made it very clear to those that there were many grave problems to be solved, before a tunnel of the magnitude of 43 feet that has been proposed could be constructed, such as the design of the shield and of the lining. There is no manner of doubt in the writer's mind but that the shield as proposed by Mr. O'Rourke has many good points, and it would seem, if a careful study of it were made in the light of the experience that was gained in the construction of the present Hudson River and the Thames River tunnels at London, that a modification of it might prove successful. This can only be determined by a most careful analysis by expert engineers and then by the expenditure of a comparatively large amount of money in its construction.

There was a manifest disinclination on the part of the engineers present to give any real consulting engineering free, and this is manifestly proper, as the states can well afford to pay for the most careful investigation of all the points involved; and the expenditure of $100,000, or more for such engineering work will certainly result in the saving of millions of dollars in useless expenditure, and in some great engineering reputations that otherwise may go on the rocks.

The remarks of Mr. Walter C. Parmley, who has had large experience in the use of concrete blocks in a smaller but similar tunnel 15,000 feet long at Cleveland under Lake Erie, makes it apparent that not all of the trouble has been anticipated in the design of the shell of the proposed Hudson River Traffic Tunnel, and that if the design is persisted in trouble will result, not only from jacking stresses in the concrete in shoving the shield ahead, but that there is very serious doubt as to the stability of the shell. This confirms the belief of other engineers of experience that leakage will most surely result if the structure is finally built These objections again are not beyond the reach of careful study and analysis.

The construction of the present tunnels under the Hudson and of those under the Thames showed conclusively that the variable pressure of compressed air required at the bottom of the shield and at the top was not a light matter in such reasonable diameters as was used for those successful structures, so it can be stated with assurance that the design of larger shields must have some special provision for taking care of the variation. The plan proposed for the 43-foot Canal Street tunnel has undoubted merit, but modifications of comparative simplicity suggest themselves, that would not only help in this way, but would also be of great advantage in keeping the shield in line vertically and horizontally.

The great objection urged by the advocates of other means of crossing the Hudson, the impossibility of properly ventilating any tunnel for such a large amount of automobile traffic as is probable and as is admitted by Mr. Byrne, is certainly the most serious, and a problem that is not so sure of finding a safe solution. The fact is that the Pennsylvania Railroad officials did not seriously consider the use of tunnels as against a bridge until it became certain that electric traction could be successfully used. The Mersey and Severn tunnels in England were built for steam traffic, but it did not require long for them to be changed to electric operation as soon as it was assured of success. The Severn tunnel it is true was practically 23,000 feet in length, and had fans 40 feet in diameter and 12 feet wide. The Mersey tunnel was 8,100 feet long and had a separate tunnel driven alongside of seven-feet diameter for ventilation, the fans being 40 by 12 feet and 30 by 10 feet in size. This will bring forcibly to the lay mind the difficulty of ventilating tunnels and many other examples might be cited to make more forcible the gravity of this problem in tunnel operation. The recent change of the Cascade tunnel on the Great Northern Railroad in the Cascade mountains from steam operation to electric is well known.

When the question was asked Mr. Byrne as to the amount of automobile traffic in the Blackwall and Rotherhithe tunnels under the Thames at London, the first named being 4,465 feet long for the enclosed portion and the latter being only about as short as this, his reply was about 40 per cent. The figures given as probable for the Hudson as derived from the East River bridge traffic was about 80 per cent of the traffic as auto cars or trucks, which is double the figure for the London tubes. Yet it is quite sure that the assertions of engineers who have carefully made personal investigations are true, that it is necessary to shut down the traffic in the London tubes at frequent intervals to allow them to clear of unpleasant and dangerous fumes.

The gas to be dealt with is the deadly carbon monoxide, which in any considerable amount is fatal, and in any amount greater than one part in 2,000 will in time cause those that are brought into constant contact with it to contract diseases of the circulatory system, such as pneumonia, paralysis, and arteriosclerosis. This was all pointed out in the August 4th, 1917, issue of the SCIENTIFIC AMERICAN in a letter signed "New Yorker," who, as the writer happens to know, has made the most extensive investigations into the subject that has been undertaken. This study was made for a similar project contemplated by another city. The SCIENTIFIC AMERICAN at that time commented on this editorially, and emphasized the need for caution in going ahead with any traffic tunnel such as was contemplated for the Hudson River. This was mentioned in the discussion at the meeting of the American Society of Civil Engineers, and attention called to a more recent article in your

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it holds a level position regardless of the swaying or pitching of the plane. The exposures are made automatically, the number per minute being regulated by a gage. The instrument is operated by a clockwork, driven by a spring, which is wound by hand. The camera holds a roll of 100 films. Taken in succession, as the plane flies, the photos would reveal a panorama of territory nearly 50 miles long, that is, if the exposures were made at an average height of 8,000 feet. From this it is obvious that rivers could be mapped with a great deal of accuracy.

When our late African explorers, such as Livingstone, Stanley and Roosevelt went into the Dark Continent to study the flora and the fauna and to bag big game, they had serious obstacles to contend with in the way of transportation. Progress was slow and the greater part of the travels was made on foot. There were long caravans of natives, carrying supplies, etc., but even these could not reach all parts of the vast jungle, where danger lurked on every side. Airplanes were unknown quantities in those days and if some one at that time had mentioned the possible use of a flying machine for exploration work, he might have been dubbed a dreamer of the wildest sort. But times have changed and it is my firm conviction that in the near future we will find the naturalist-hunter soaring over the jungles of the wild country and with either a rifle or a machine gun bag his elephants from the air.

That this is no idle speculation but a perfect possibility I gained from Mr. Charles Cottar, formerly of Oklahoma but lately of Nairobi, British East Africa. He went to Africa in 1910 and since then has become quite familiar with the jungle, where he went big game hunting. Since his first visit to the Dark Continent he has made three trips back to the United States to obtain supplies. Mr. Cottar did not let the war go through without seeing service. He was a lieutenant in the Intelligence Section of the British Expeditionary Force for 14 months, serving as a scout. He left Uganda October 20th and arrived in New York from Capetown December 23d. Mr. Cottar took "movies" of all his hunting trips and these, he says, he will preserve as a record for his family and friends.

I called on Mr. Cottar shortly after his arrival in New York and asked his opinion on the airplane as a transportation medium in exploration work. I found him very enthusiastic over the idea and he said that he wished many a time that he had an airplane when hunting elephants. When these animals hide in the tall buffalo grass, which is higher than the elephants, it is hard for a hunter to approach them. Mr. Cottar said that elephants in droves of 1,000 or more are found in this grass. His idea would be to fly over the herd and then blaze away with a rifle or a machine gun at the animal selected for prey. After the herd had been frightened away, it would be an easy matter to venture into the field on foot and take charge of the carcass.

Conditions in some parts of Africa are such, according to Mr. Cottar, that the airplane could be used to desirable advantage in reaching places which hitherto have been inaccessible. The following is his statement on the subject: "From Nairobi to the Abyssinian border, a distance of about 325 miles, there is a first class automobile road which has been used for military purposes. On each side of this road we have what is known as the North frontier country, and this is partly desert and a very large area of it is unexplored. It would be easy to use this road as a base for airplane trips into the interior of the country and from my knowledge of the land, there are open spaces on which landings could be made.

"Then again there is a railroad running from Nairobi to Lake Victoria Nyanza, and after this has been crossed by boat the

journey could be continued by a good truck road for a distance of 165 miles to Fort Portal. Nine miles distant from this town we have Mt. Ruenzori, a peak of about 16,700 feet. The summit of this mountain is seldom seen on account of the clouds that constantly hang about it. Southwest of Mt. Ruenzori is a vast unexplored country, and by looking at the map you will find no markings as to what a person may find here. This should surely offer a most promisingly fertile field for the explorer.

"Forty miles south of Fort Portal is an open and flat country, the elevation above sea level being not over 3,500 feet. The grass here is not much over six inches high in many places and it would be just what an aviator would want for landing and starting his machine. If an airplane could fly a distance of 200 miles from this point and return the aviator would have an excellent opportunity of making observations over a country, which, as far as I know, no white man has ever seen before. This is the territory that is known for its savage dwarf-like cannibals and the home of big game. Elephants are found by the thousands, not mentioning lions, tigers, and other beasts of the forest.

"I believe a hunter while in flight could bring down a tusker without any trouble. The battleplanes in Europe have flown over trenches while machine guns were spraying lead on the enemy. Apply the same tactics when after big game, and you are bound to get something. The flying machine could also be used for carrying an animal like a killed lion or a leopard from the interior to a highway or a railroad for transportation."

As before stated the type of airplane used for exploration work would have to be of a different design than that used for commercial or military purposes. I will give a description of a twin motor tractor triplane, designed by Leon N. W. Colin, a young aeronautical engineer, of New York, and which he says would fulfill the requirements of a plane for the exploration field.

The machine, which is the cover subject of this issue, would have a span of 77 feet, a length of 43 feet, a maximum height of 19 feet, gap between the wings six feet, total weight 9,600 pounds, useful load 5,800 pounds, and it would be equipped with two 300-horse-power engines. The machine would have a minimum mileage of 850 miles, 10 hours range of action, and it could reach an altitude of about 20,000 feet.

Its landing speed would be 30 miles per hour. The fuselage is six feet high, four feet wide, and 40 feet, 6 inches long. It is mounted between the center and the lower wing. The tanks are located in the fuselage, also compartments for carrying supplies, spares and cargo amounting to a total weight of 2,200 pounds. In front is the open pilot's compartment, and back of him the enclosed compartment for two persons.

The span is 75 feet, the center-section is 16 feet wide and the wings are hinged thereto, so that they can be folded backwards to occupy a small space. When the wings are folded back, the machine requires a road width of 33 feet for traveling from one point to another. The ailerons are counterbalanced and are located on the upper and center planes and inter-connected.

The landing gear is of the double-wheeled V-type, with a distance of some sixteen feet between the skid portions thereof.

Three stanchions in a vertical plane on each side of the center section under the motor are the features of the chassis supporting the machine. Two additional stanchions brace the fuselage diagonally to the chassis, and the wheels are so mounted as to permit the change of its vertical axis with respect to the nature of the ground and its irregularity. Rubber chord is used as shock absorber, and it is enclosed in a housing in order to prevent entangling

in the grass. If the machine is landed in high grass there is a maximum distance of six feet provided before the top of the grass will touch the wing center-section. The tail skid is designed to give as little obstruction as possible in high grass. The skid is of the swivel type, to prevent racking the body in side landings. Rubber chord is used as shock absorber.

A biplane tail is used. The tip counter-balanced elevators are hinged to the stabilizers, and three counter-balanced rudders are the support of the upper stabilizer plane; one in the center, and one on each side, in the center line of each motor. A wheel is provided in the cockpit to change the angle of incidence of the stabilizers. If the machine lands in high grass, and the motors are running, the stabilizers are put to their maximum angle of lift in order to carry the weight of the tail. The flexibility of the grass is such upon the inclined stabilizer as to aid materially in its raising. Upon clearing the grass the stabilizers are set at their normal angle. The machine is able to fly and climb with only one motor running.

A Universal Printing Machine

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regularity of operation that stops the machine, of course it falls in the right place.

This accomplished, the paper moves forward—11 inches, bringing the next length in position. In passing forward this distance, it passes through what amounts to a cylinder press, and it takes impressions from two electrotype plates—one for the letterhead, one for the signature, autograph or otherwise. After it stops again at the end of these operations, it is cut off to a length of exactly 11 inches—and there is the complete letter. Provision is made for a double printing of the letterhead, so that part of this may be in, say, red and part in black, while at the same time the signature may be in any color at all; in fact, the only limitation to the four-color effects obtainable is that the fill-in must match the body of the letter, being printed through the same ribbon.

In addition to this operation of printing filled-in circular letters, which is what the machine is primarily designed for, it possesses other capacities. It can be converted into an ordinary printing press by the shifting of two gears, cutting out the ribbon-printing mechanism. The paper then flows through the machine continuously without starting and stopping and letterheads, order blanks, laundry tickets, hand bills, etc., may be produced at from 35,000 to 50,000 per hour.

Again, with a very simple attachment we may convert it into an envelope machine, which makes a complete envelope, barring one fold of the flap which must still be done by hand. The envelope is creased and gummed ready for the fold, and at the same operation is directed from the drawer of address plates, and receives the return card in the corner. The same speed is here attained as in the case of the circular letters.

An interesting added feature is the ruling device. A set of ruling pens is mounted over the web of paper, which of course always moves in the same plane. By proper settings of these pens, any desired longitudinal ruling may be obtained; and as the paper flows through the machine cross-rulings and column headings are printed. The primary purpose of this is to make possible the printing of order blanks, but of course many other varieties of business stationery can likewise be turned out.

The Canal Street Hudson River Tunnel

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issue of March 8th, 1919, in which it was claimed that you had retracted your former statements. The writer's understanding is that the more recent article was simply an acceptance of the conclusion that if a much larger percentage of carbon monoxide was safe, then it might be possible to ventilate the tunnel as now proposed to that extent.

The fact remains that up to the present the public have nothing more than an assertion on the part of the advocates of the Canal Street project that it can be ventilated, and it would be a great satisfaction to all concerned if the scientific investigation of this very vital matter could be published in full. This would certainly be more satisfying to engineers and to others interested, than the delivery of invective and ridicule of those that have the termerity to question this particular point. The statement was made by Mr. O'Rourke in the discussion that the figures made by the writer of the article in your issue of August 4th, 1917, were based on the friction that would be encountered in the rough bore of a mine; and without attempting to refute this statement, any one who has in the least considered this vital question must at once have decided that the wagons and autos packing the tunnel full, would create eddies in the air current that would be many times the obstruction to the ventilating current that could be offered by any kind of rough surface or lining in a tunnel.

The writer is one, who like Mr. Lindenthal, is anxious, if the matter cannot receive an unbiased investigation and report, to see the tunnel quickly built to arrive at a practical settlement of the whole controversy. The remark of one prominent engineer that it was better to build one small tunnel at Canal Street, and later others at points above this location in order to prevent the congestion that would follow the completion of the proposed big tube, applies with equal force to the trying out of this matter of ventilation on one small tunnel before spending so much of the public funds in what is most surely an experiment.

The writer hopes that Mr. O'Rourke will be allowed to build the tunnel, if it can be determined that the best interests of the two states will be best served by such a means of carrying the traffic across the Hudson, but I believe with Mr. Forgie that the figure named by Mr. O'Rourke is about 50 per cent too low, and I should regret it if the contractor were involved in such a loss, nor do I wish to see the states drawn into any such great loss.

CHAS. E. FOWLER,
New York. *Consulting Engineer.*

Fuel from Household Waste

A METHOD of utilizing ordinary household refuse has been invented by Mr. Reginald Brown (President of the Institute of Municipal Engineers of England), who has supplied the following particulars. The process is in operation at Southall, Middlesex.

It is claimed that the whole of the refuse collected from houses (such as ashes, cinders, paper, straw, and vegetable matter) can be dealt with and turned into fuel, thus conserving the coal supply. Mr. Brown assumes that in a community having a population of 100,000 there would be 25,000 tons annually of refuse, and he shows that the sale of the prepared fuel even when marketed at a low price, would result in considerable revenue and profit.

On arrival at the refuse disposal works the refuse is tipped into a crusher and reduced to a powder. It is then lifted by an elevator and made into small blocks by means of a briquetting machine. No binding material is added at this stage.

From the briquetting machine the blocks are placed on carrying trays capable of holding approximately one ton, and conveyed by means of an overhead traveling pulley into a drying store. One day is usually for air drying—the briquets being fairly porous—and on the following day the trays containing the briquets are dipped bodily into tanks holding a mixture of oil-tar and pitch of such a consistency as to permeate easily and quickly the whole of each briquet. Thence the blocks are taken to the storage bins and can be used as fuel when and where required. If fuel