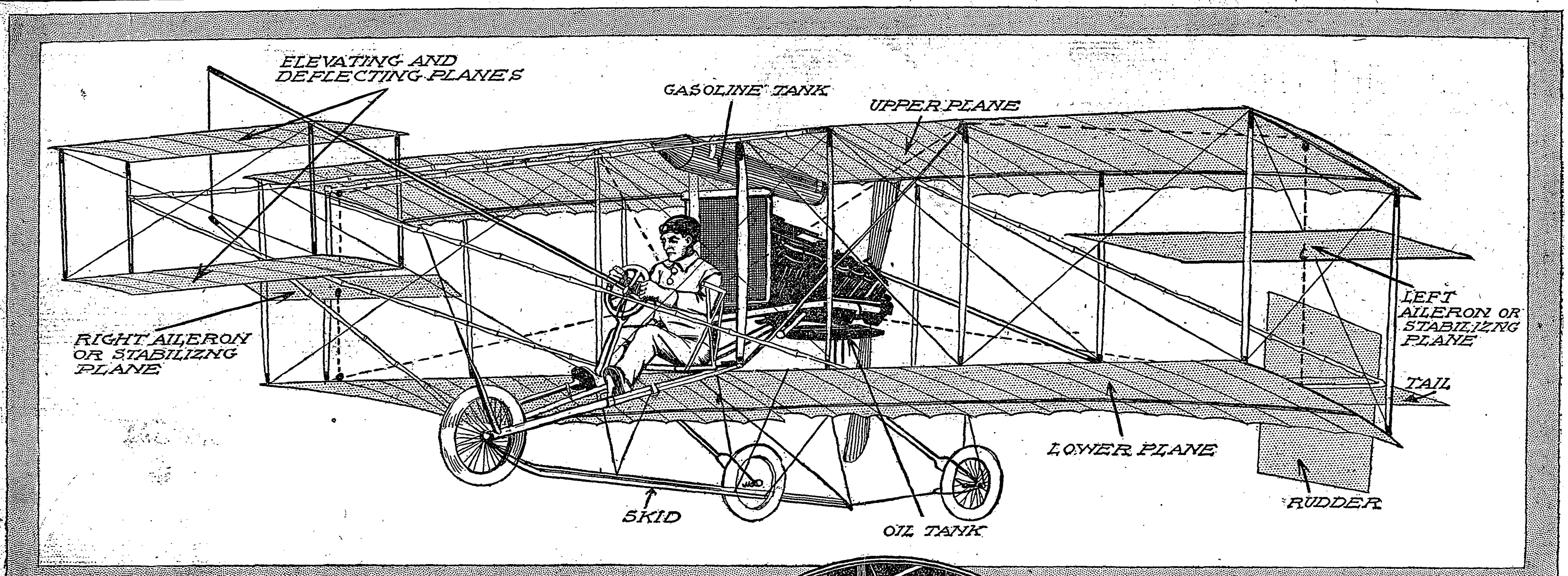
CHARLES K. HAMILTON TELLS HOW TO RUN AN AEROPLANE



The upper and lower planes and the tail are stationary. ***The rudder, the forward elevating and deflecting planes, and the right and left ailerons or stabilizing planes must all be controlled by the aviator from his seat. The dotted lines represent wires that are fastened to the upper and lower surfaces of the ailerons or stabilizinz planes, and connect through a system of pulleys with the movable seat back of the aviator.***

The Intricate Mechanism of His Biplane Explained in Detail Showing the Uses of Every Part.

DRIVING an aeroplane at the speed of 120 miles an hour is not nearly as difficult a task as driving an automobile sixty miles an hour." This was the surprising statement made by Charles K. Hamilton, the daring aviator who is to attempt the unparalleled feat of making a round trip through the air from New York to Philadelphia.

"In running an automobile at high speed the driver must be on the job every second. There are constant opportunities of encountering obstacles. For instance, a man can never tell at what moment he is to encounter some vehicle, perhaps traveling in the opposite direction. Nothing but untiring vigilance can protect him from this danger. Then there are turns in the road, bad stretches of pavement, and other like difficulties. All these require the same attention.

"But in an aeroplane it is an entirely different proposition. Once a man becomes accustomed to aeroplaning, it becomes a matter of unconscious attention. For instance, let me give you as an example the bicycle. Nearly every one has at some time or other ridden one, and these can appreciate my point. They will remember how, when they first mounted the wheel, maintaining their equilibrium was a matter of nerve-racing vigilance. In their efforts to maintain it they would invariably put the wheel too far to the falling side. Whenever they saw an approaching vehicle they felt a moral certainty that they would be run down, and in order to avoid this catastrophe would make ridiculously wide detours, but a little practice and the equilibrium was unconsciously maintained. They were soon riding without the use of the handlebars, maintaining their poise simply by an unconscious shift of the body. Approaching vehicles became an equally simple problem.

"Now, that is exactly the situation with an experienced aviator. He has no obstacles to encounter except cross-currents of air. Air and wind are much quicker than a man can think and put his thought into action. Unless experience has taught the aviator to maintain his equilibrium instinctively, he is sure to come to grief. Why, when I am traveling at the rate of sixty or eighty miles an hour a thousand or more feet above ground, my thoughts usually run on subjects unrelated to aeroplaning. So far as the air currents are concerned, I rely entirely on this instinctive action; but my ear is always on the alert. The danger signal of the aviator is when he hears his motor miss. Then he knows that troubles are in store. Sometimes he can speed up, just as an automobile driver does, and get it to renew its normal action. But if he fails in this and the motor stops, he must dip his deflecting planes and try to negotiate a landing in open country. Sometimes there is no preliminary signal from the motor that it is going to cease work. That is the time that the aviator must act quickly. Unless the deflecting planes are manipulated quickly, aviator, aeroplane, and motor will rapidly land a tangled mass on the ground."

"Just how is an aeroplane driven?" asked the reporter.

"Before answering that question," said Mr. Hamilton, "I had perhaps better describe the mechanisms with which I have to work. You see, it is not only necessary to have planes to support the machine and a motor to drive it through the air, but it is also necessary to have a rudder to steer it, another rudder, so to speak, to raise and lower it, and wings to preserve its equilibrium. When men started to fly they thought that it would be sufficient to provide the power to drive their machines and the kitelike surfaces to raise them. It did not strike them that a kite, even with a long tail and no weight to carry, plunges in all sorts of dizzy ways. So, when they built an engine sufficiently light and powerful and fixed to it the slanting planes to take it aloft, they were very much puzzled at first to find that their machines invariably crashed down to earth after rising a few yards.

"They thought that a steering gear, somewhat similar to a ship's rudder, to turn their aeroplane to right or left, would be sufficient. Then they added a second rudder to guide their machine upward and downward. Even this was not sufficient. Afterward came the all-important contribution—a device that would keep the flier 'on an even keel,' something that would keep the planes from overturning sideways. But all of these rudders or controls are dependent upon the aviator. The machine that will automatically maintain its equilibrium in the air is still a thing of the future.

"For my part, I do not believe that there will ever be an automatically controlled aeroplane. Such a contrivance would tend to drive an aeroplane through counter air currents, and the machine would be hopelessly ripped to pieces. They will get an automatic control for an aeroplane when they devise a pair of eyes for an automobile that will guide it down Broadway without collision.

"In the Curtiss aeroplane, which is the type that I use, there are the two big sustaining planes, the upper and the lower, which are familiar to all. Between these is located the motor that supplies the power to force it through the air. This engine is similar to the gasoline explosion motor used in an automobile with this slight difference—the controls for the magneto and gasoline supply are placed forward of the engine, where the driver's seat is located, and the engine cranks up directly by the turn of the propeller.

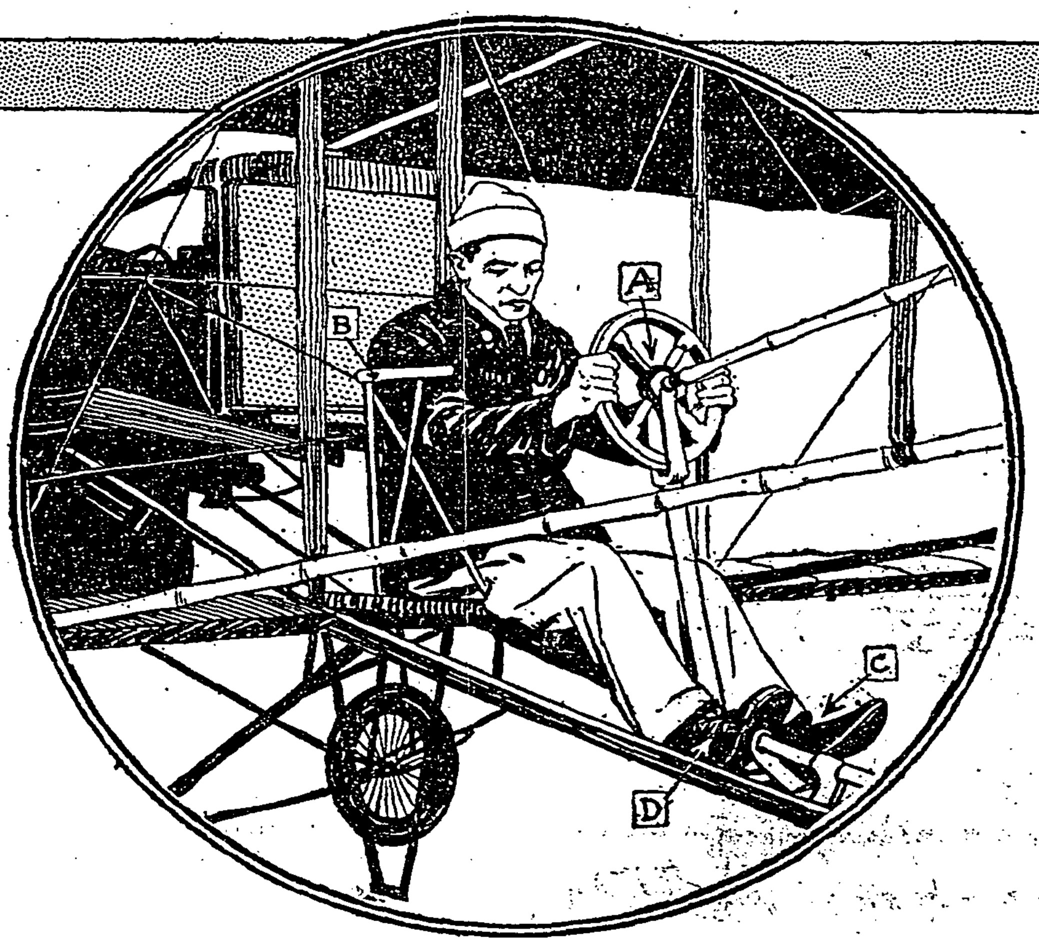
"Projecting behind these two planes, and held by a skeleton framework of bamboo rods, is a small horizontal plane known as the tail. This is stationary. The tail partially bisects the rudder, which guides the right and left action of the aeroplane. This rudder is manipulated by wires that run to a wheel similar in size and appearance to the steering wheel of an automobile.

"At a slightly smaller distance in front of the aeroplane and supported by a similar skeleton framework of bamboo are the elevating and deflecting planes, which might be called the altitude rudder. The function of this contrivance is to turn the course of the aeroplane up or down. It consists of two horizontal hinged planes. When these planes are tilted so that their front edges point upward, the air through which the aeroplane is advancing catches on their under side. This pressure of the air on the planes lifts them up, and so lifts the nose of the whole aeroplane, making it take an upward direction. When, on the other hand, these planes are tilted downward, the air, as it is cut, presses on their top surface and thus gives the aeroplane a downward direction. Without this altitude rudder the aeroplane would be helpless. It could not rise from the ground, nor could the aviator, if he found himself in unfavorable currents, pass from one air stratum up or down to another. Above all, he could not alight, for in the last moment before alighting the nose of the aeroplane is thrown up sharply to let the great planes catch the air and stop the momentum.

"This altitude rudder is controlled by a long rod, which runs to the wheel which controls the rear planes or rudder that guides to right and left. By pushing on the wheel it shoves the rod forward and turns the nose of the altitude rudder upward. By pulling the wheel toward him the aviator turns the nose of the altitude rudder downward. Thus you see that this wheel guides the aeroplane not only to right and to left, but also to up and down. This wheel has a backward and forward thrust of twenty-six inches, but I have never used a greater movement than five inches. If I used the limit I would go head-over-heels. In negotiating the ordinary air current a half inch push or pull on this wheel is all that is necessary.

"This wheel should not be held more firmly than one holds a billiard cue. That may sound strange to the man who has never navigated an aeroplane, and only knows that the aviator's neck depends on a few-inch movement or slight twist of that wheel, but this stranger to air sailing must realize that the aviator gets his first warning of dangerous cross-currents through the front planes when they stick their noses into them. These sudden tensions communicate themselves through the connecting rod to the wheel, and it must accordingly be held loose to preserve the necessary sensitiveness. The moment these front planes buck into a cross-current of wind the aviator instinctively knows just what is ahead of him and how much he must dip or elevate his front planes and how he must raise or depress the ailerons.

"This brings us to the last control that the aviator has to handle, a control, by the way, which was the last and most difficult problem that the men wrestling with the aerial problem had to solve. This knotty question was the difficulty of keeping the aeroplane on an even keel or preserving its equilibrium. By the use of side fins, or stabilizing rudders, this was finally attained.



WHERE THE AEROPLANE IS CONTROLLED.

A. Steering Wheel—A twist moves the rear rudder, giving right or left direction to the aeroplane; a thrust or pull moves the elevating and deflecting planes.
B. Swaying Seat Back—By leaning to right or left the aviator controls the ailerons or stabilizing planes.
C. Small lever that controls motor throttle.
D. Lever by which magneto may be short circuited, thus stopping the motor, and brake applied to front landing wheel to check momentum when alighting.

"To understand the use of these, the most continuously employed pieces of steering gear on an aeroplane, it is necessary to remember that an aeroplane is poised as delicately on its airy keel as a tight-rope walker on his wire. The ailerons perform the function that the balancing pole does for a tight-rope walker. They save the flier from tipping over.

"Once more it is an application of the principle of catching the wind on the under side of a horizontal plane to get an upward pressure and on the upper side to get a downward pressure. One of these ailerons is placed on each side of the aeroplane about midway between the upper and lower planes. They project about half their length beyond the ends of these two main surfaces, or supporting planes. They are warped or controlled by a system of wires running through pulleys and connected to the back of the aviator's seat. This seat-back swings from side to side. When it sways to the right it pulls the wire drawing down the rear of the stabilizing plane out at the left wing tip. When the seat sways to the left it draws down the stabilizing plane at the right wing tip. The wiring is so arranged that when one stabilizing plane has its rear edge pulled down by the tilting of the seat-back the same pull raises the rear end of the opposite stabilizing plane. Whichever way one stabilizing plane is turned, the other one is oppositely.

"The manner in which this action rights the aeroplane will be readily understood. The process is as follows: As soon as, in the course of flight, the aeroplane sags to the left, the driver leans over to the right in his seat. It is the motion that he would naturally make to find his own equilibrium. In leaning to the right he pushes the seat-back over with him. This pulls the wire that draws down the left stabilizing fin's after part. Thus the fin turns on its axis, or in such a way as to present a slanting under surface to the wind. The wind delivers an upward pressure on this surface, and this upward pressure tends to right the sagging left end of the aeroplane. At the same time the pull that started from the seat-back is sent on from the left fin over the overhead wire and down to the upper surface of the right fin, which is drawn up. The right fin is thus made to present its upper surface to the wind, and the wind then depresses the right end of the aeroplane at the same time that the left is being raised. In a moment the aeroplane is righted. The driver thereupon straightens up in his seat, bringing the seat-back again to the upright position and so drawing the stabilizing fins back again to their original place. The movement is a natural one for the driver, so much so as to be automatic.

"Then there are two other mechanisms which the aviator must control. There are two small levers which he operates with his feet. With a pressure of the right foot on a small lever he short circuits the magneto, thus stopping the engine and at the same time throwing on a brake which acts upon the front landing wheels, greatly reducing the momentum of the machine as it strikes the ground. The right foot also works a pump which forces the lubricating oil faster or slower from its tank to the engine.

With his left foot the driver operates another small lever which controls the throttle of the engine. By this means he can regulate the flow of gas to the eight engine cylinders. He can cut the revolutions of the propeller down to 100 a minute, which will give a forward thrust of thirty pounds. The maximum number of revolutions of the seven-foot propeller is 1,200 per minute, which develops a thrust of 300 pounds. The normal speed of the propeller is 1,100 revolutions per minute, giving a thrust of 270 pounds and developing a speed of fifty miles an hour in still air.

"It is traveling with the wind which enables the aviator to make his high-speed records. The breeze adds its own speed to that supplied by the motor, and when traveling against the wind the rate of the breeze has to be subtracted exactly as tide flow must be reckoned with in water navigation. This tide comparison holds good in another way. The tide is always slowest near the shore and swiftest in the middle of the current. So, too, the wind is always slower near the earth's surface and moves quickest as it is freed from the friction of the solid surfaces of the ground. This change of air current speeds keeps the aviator from knowing what he is going to face until he has cut loose from the surface currents.

"As I have said, negotiating these upper currents, though in hilly country, or even over woodland or city, are often thrown into sudden and conflicting channels, is an easy matter. If the aeroplane simply starts to drop it is only necessary to push the steering wheel forward half an inch, rarely more, to bring it up again. Usually the aeroplane starts to drop on an uneven keel. Then there are three motions. The first is the one I have already described. The next two come together. The aviator leans to the high side which moves the ailerons through the action of the seat-back and at the same time he twists the steering wheel to the falling side. The seat-back has a total movement each way of eight inches, but it is never moved more than two inches in practice. In aeroplaning success lies in catching trouble in its infancy.

"The eye is unconsciously kept watching for forest land or cities. These make impossible landing places in case of the stopping of the motor, but in encountering districts of this kind it is only necessary for the aviator to keep up a certain distance to be sure of clearing. He must keep up one-third or one-quarter as high as the bad country is long. If this country is, for instance, 1,000 feet long, he must maintain an altitude of 250 feet, because with proper handling the aeroplane will glide forward three feet to every foot that it drops. A man flying over New York City should keep up 1,500 to 2,000 feet. This would make him safe as far as the stoppage of his motor is concerned. Of course he would land in either the East or North River; but an aeroplanist should not mind a swim.

"He must also keep his eye on the bolts which hold the rods controlling the front or elevating planes. Should one of these lose a nut and come loose it means certain death, for the aviator, with his control of those front planes gone, is absolutely helpless and drops to the ground like a stone. No man has ever lost cootrol of these planes without being killed.

"I often hear people say, 'Well, they are getting aeroplanes down pretty fine these days,' but the aeroplane itself, as a mater of fact, remains just the same as it was three or four years ago, when they only sailed in hundreds of feet. The only improvement has been in the motors. Unless they do more in the next three years the art of flying will remain at a standstill."

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