

"GEORGE"

AN EXPERIMENT WITH A MECHANICAL AUTOPILOT

By H.J. TAPLIN*

The late Col H. J. Taplin forwarded his account of the conception of a mechanical "George" through Mr. R. G. Moulton, Director, Model & Allied Publications, Ltd. He had attained the rank of Captain during WW I, went on to Colonel in WW II. With a life-long interest in model aircraft he had instituted some important competitions during his stay in Spokane, and is today well known for his production of model airplane engines. He also pioneered in electrically-propelled, radio-controlled airplane and boat models and had directed crossings of the English Channel of the latter.

Col. Taplin was a director of Birchington Engineering Co. Ltd., Birchington, Kent, England. Shortly after receipt of his article printed here, he passed away during a holiday on Malta, on 20 April 1969.

Quoted from the Washington POST, dateline Sept. 1st, 1927.

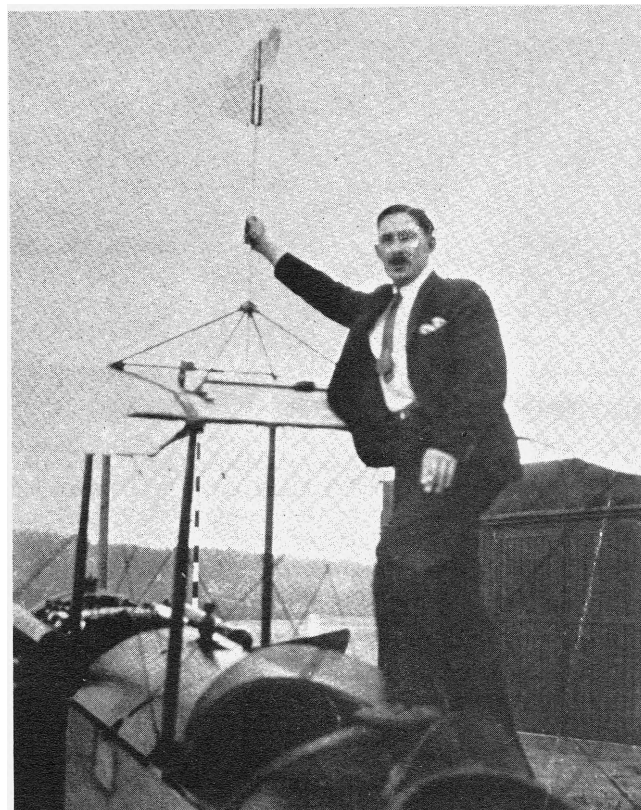
AUTOMATIC FLYING

More than ordinary interest should attend announcement of the invention of a device by Capt. H.J. Taplin, an Englishman now resident in Spokane, which makes possible automatic flying. Through the use of vanes exposed to the wind currents and attached to the control lever, an even keel is maintained on the straightaways, the machine is automatically banked when the rudder is turned, and straightens itself out when the turn has been completed. Thorough tests are said to have been made of a trial installation, following which experienced aviators characterized the device as entirely practicable.

The new development makes it necessary for the pilot of a plane to concern himself only with the throttle, which governs its speed, and the rudder, which changes its direction. Takeoffs and landings, of course, would have to be made manually, and if it were necessary to change altitude the pilot himself would have to guide the change, but as long as flight were maintained at a given level the pilot would be as free as the operator of an automobile after having placed his car in high gear.

Thus the pilot would be released for other duties which might require his attention. On long distance flights, for instance, he would be free to leave the control panel long enough to take observations and compute his position. At any time he could, without endangering the plane or its other occupants, make minor mechanical adjustments of his motor. With such a device the pilot would no longer be a fixed part of the machinery . . .

In this day and age we accept the automatic pilot on practically all aircraft as a matter of course. So sophisticated has it become that many modern airliners are automatically landed nearly without the aid of the pilot. But how was the original idea conceived and in what form? In order to give the detailed history I can only write this in the first person.



Mr. H. J. Taplin, then President of Spokane Airways (1927) with his demonstration model autopilot on Hisso-powered Standard Biplane.

For some years prior to my first taxiing, "straights" and, finally, circuits on an Anzani-engined Monoplane at Shoreham in early 1910, I had, as a teenager, been a great model aeroplane enthusiast. In these early days the only power available for model aircraft was the rubber motor. This had the disadvantage that when launched the rubber motor gave more power than was desirable, making the model climb at a steep angle, and as the rubber motor lost power, the model tended to stall, since at that time we had not yet achieved a design giving reasonable fore and aft stability.

Practically all model aircraft at that time were of the "pusher" type i.e. with the elevator in front, like the early Wright Bros. Kitty Hawk, known as Canards. In our rubber driven models, if we could only arrange for the elevator to be tipped down automatically as the speed reduced, the machine would take up an angle suited to its speed.

Thus it was that I fixed a spring-loaded vane facing fore and aft directly connected to a swivelling elevator to a model biplane. After a considerable amount of experimentation in spring loading adjustment — it worked.

It was, therefore, not unnatural that it was not long after the start of World War I before I was in the Royal Flying Corps. It was after the initial ground work of morse code, meteorology, map reading, etc. that I found myself under dual control of the Old Maurice Shorthorn, graduating to the Avro 504E, and subsequently to active service.

It is reasonably true to say that all machines at that time were inherently unstable, that is to say that they had to be "flown" all the time; this applied to even later machines such as the D.H.6. (known as the "Clutching Hand") Sopwith Pups, Camels, D.H.4s and 9s, and Bristol Fighters, etc. The flying of these machines highlighted to me the necessity for some kind of automatic control.

Now, whilst my early experiments with models was applied only to fore and aft control, my further experience with full size machines brought in a further factor, that of lateral control. It was, of course, known that when a machine is banked without rudder, the machine side-slips to

the side of the dipped wing, and the pilot received a blast of air on the dipped wing side. Inversely, if one rudders without bank the machine skids outwards causing a blast of air on the pilot on the opposite side to the turn.

It would, therefore, appear that if further vane was incorporated edge-on to the line of flight and interconnected to the aileron control, so that the over-banked wing was lifted by the aileron control operated by the side pressure on the lateral, inversely in the second case of ruddering without bank, the aileron control was operated to stop the skid, i.e. to put the machine in the correct bank for the amount of rudder.

Having arrived at this theory, part of which I had already proved with models, I was able to formulate a patent which was subsequently accepted in its complete form in 1918. Whilst having tea with the late A.V. Roe at the Royal Aero Club shortly after being granted the patent, I described to him its principle, asking him if, in his opinion, it would work in practice on full size machines. "Undoubtedly it would work but it is too early" was his reply. We were, of course, right since none of the aircraft manufacturers were interested and as I had no full size machine it had to remain on paper.

It was in 1926 that I went to America on an engineering project, there I met a Scottish friend who had known of my flying experience and who promptly told one of the local papers in Spokane of my presence as a British pioneer. I should explain that at that time America was probably ten years behind Europe in flying matters and this publicity resulted in my receiving a number of offers from various quarters. Subsequently, I accepted an offer as president (managing director to us) to form Spokane Airways, backed by one Sam Wilson, a wealthy stockbroker.

When for the first time as the "boss" I was able to earmark a machine, a two-seater Lincoln Standard powered by a Curtiss 0X5 90-h.p. engine, for my experiments, and to have the first crude "flag pole" auto pilot fitted. The "flag pole" mounting was to ensure it being clear of the slip stream of the propeller. It was mounted in a ball joint, with foreward and lateral movement and both fore and aft and lateral control vanes were mounted together on the top of the "flag pole."

The lateral control was interconnected with the aileron control and spring loaded to a neutral position whilst the fore and aft control was connected to the elevator control, but spring loaded in a forward (or down elevator) direction with a quick action spring variation control in the cockpit. It should be noted that the manual controls of the joy stick had not been interfered with.

Obviously, I preferred to carry out the preliminary test personally. On the first test flight I had no idea of the spring loading of the elevator vane was necessary and so took off manually overcoming the vane action.

Climbing to a safe height, closing the throttle to a level flying cruising speed of approximately 70 m.p.h. I then eased off my manual control and found that the adjustable spring-loading had to be increased considerably. I finally got this adjusted until the joy stick remained stationary with a constant speed of 70 m.p.h.

I then closed the throttle slightly, and the nose dropped but the speed remained constant at approximately 70 m.p.h. Opening the throttle somewhat past my original cruising speed, the nose rose and the machine climbed at the same speed. Cutting the throttle to a tickover, the machine dropped to a steady glide of 70 m.p.h.

I then proceeded with lateral control, by ruddering without applying bank; there was some slight delay, before the lateral control took over, when the "bubble" centralized itself and the bank remained constant. I then manually dropped one wing with a straight rudder; releasing the manual control the wing immediately rose to level flight. I

carried out numerous manoeuvres manually, allowing the auto-pilot to take over and in every case the result was conclusive.

I finally manually put the machine into a spin (which is, of course, stalled flight) and releasing the joy stick, the auto immediately dropped the nose to a dive, flattening out to a steady 70 m.p.h. Feeling well satisfied that the auto did all that I hoped, I manually landed the Lincoln.

Later in the day I decided to try a few more "tricks." Having left the spring loading on the elevator as it was, i.e. with a climbing speed of 70 m.p.h. at full throttle, I decided to try a takeoff on auto control using only rudder. Standing stationary the elevator was hard down. On opening the engine to full throttle, the fore and aft vane was pressed back and, at 70 m.p.h., the machine took itself off and settled to a steady climb.

On this flight I decided on a manoeuvre that I had not tried. Climbing to a more than safe height, I manually dived and pulled up to a loop. When approximately at the top of the loop, I cut the engine and handed over to auto. The result was to say the least of it surprising and unorthodox. With the engine cut the speed dropped and the auto tried to correct by putting the nose down, but as we were upside down the down elevator meant that the auto tried to get out of it by doing the upper half of a vertical figure S. The poor 90 h.p. Standard would not stand this. Just reaching a more or less vertical position it promptly fell out of it into "hammerhead."

Having got us into this mess and having lots of height, I left it to auto to get us out of it, being prepared for anything. I was, however, disappointed, since all that the auto did was a straightforward correction, and settled for a steady glide at the set speed. This was the only manoeuvre I could find in which the auto was unorthodox.

I carried out many more tests, but needless to say the American papers were already printing the fact that a "fool-proof aeroplane was under test at Spokane," and subsequently I was asked to give a demonstration to some of the Army, and the Press. I normally carried out these tests from the back cockpit, and for the demonstration I took off under auto with my hands in the air and carried out various gyrations in this manner.

Obviously one could not have a "flag-pole" on the top of a machine, so I had another built which was much more sophisticated and fitted to a Buhl Air Sedan passenger plane. The details of this are unnecessary, suffice to say that the vanes were separated and more or less unnoticeable. In those days passenger aircraft had only one pilot, and when I left the cockpit and walked down the aisle between the passengers, they nearly had kittens, until I told them the machine was flying itself!

I was not too happy with the slight lag I experienced with the lateral control, and realized I needed a fixed point in space, i.e. a gyroscope, so when I returned to England at the end of 1928 I took out a provisional patent incorporating the use of a gyroscope or the like. For nearly a year I hawked this about all the big names in the aircraft industry, but nobody wanted to know, so somewhat frustrated I had to let the provisional patent die. It was not until 1933 I believe that Sperry brought out what was supposed to be the first auto pilot.

Obviously with the passage of time, the old "flag-pole" autopilot, like the old Model T Ford, has developed into the most sophisticated piece of mechanism which can, and does, land an airliner unaided.

Note: Experiments with a gyroscopic controlled autopilot date back much earlier. See Keller, Charles L. "Automatic Pilot, 1913 Version" *Sperry Engineering Review*, Oct. 1960, and "The Aerial Torpedo," *SER*, March 1961. Illustrations show Lawrence Sperry in a Curtiss Flying Boat under automatic control on 18 June 1914.