

DESIGNING AND BUILDING A BIPLANE.

THE STORY OF A SUCCESSFUL EXPERIMENT.

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(Concluded from page 206.)

ON March 28th, Ding made two further flights of 15 minutes each, taking Mr. Mann as passenger in the second one. The chains jumped worse than ever, and two of Hans Renold's experts were absolutely horrified at their extraordinary behaviour. The speed was about 70 m.p.h., but the general performance was so short of Mr. Mann's expectation that it was decided to make very drastic alterations and to instal a 125 h.p. Anzani in place of the original 100 h.p. In the light of subsequent knowledge I regard the substitution of engines as a very great mistake, as it materially increased the loading and head resistance, and thus nullified the extra power. Later, I shall give a short list of the alterations, and point out the defects in the original machine, and the reasons that led to these defects. It is worthy of note that in this first Hendon period we only got in less than an hour's flying. On April 1st (of all days) we moved back to Surbiton with the "bus" and all our impedimenta.

Now, our troubles were two in number: (1) lack of rigidity in the transmission, chiefly in the diamond-shaped stays supporting the propeller shafts, of which stays the front pair were wires and the rear pair steel tubes, and (2) the excessive weight of the machine necessary to secure a high factor of safety in so experimental a "bus." The original machine with crew and fuel on board weighed over a ton, and the loading approximated to 9 lbs. to the square foot, but in spite of the manifest defects, its early performance of 70 m.p.h. speed and its 400-500 ft. per min. climb, put it in the very front ranks of "pushers." Had the transmission gear been as reliable as it afterwards became, there is very little doubt but that the machine would have been at once purchased by the Government, but the alterations occupied so long a period that by the time they were completed we had to face a rival in the shape of the twin-engined gun "bus," of which more anon. When the "steamroller" was dissembled after the flight of March 28th, it was discovered that the gearbox and its plate had been moving about and bashing the petrol tank, which would assuredly have burst had the flight, in which Mr. Mann went up as passenger, been prolonged a few more minutes. Furthermore, each radius rod had sheared through its bolt at the gearbox end, with the result that the chains had each been pulling to the extent of a thousand pounds or so against the wing spars. Owing to the jamming of the safety valve in one of the petrol tanks, not the one "strafed" by the gearbox, it was on the point of bursting with the volume of air pumped into it by our automatic pump and was distorted completely out of shape. By way of climax the chains had only kept on their sprockets by a miracle. A period of drastic alterations now commenced, including a new chassis, larger wheels, new propellers to absorb the increased power, a still larger rudder, more forward stagger, and the complete elimination of wires from the transmission. The new engine necessitated heavier shafts, sprockets, chains, radius rods, bridge pieces and gearbox. The difficulty in obtaining material was so great that it was not until the end of June that we saw Hendon again.

During part of our first visit to Hendon we had been housed in one of the L. and P. sheds, but we were soon moved from this to the large Navy shed. When we returned at the end of June, we were unable to get a shed of any kind either from the Navy or the Grahame-White Co., so we were compelled to import a tent, which was pitched near the Hall School. Ding made his sixth flight on Tuesday, June 29th, and the general show the "bus" put up was inferior to her March form, and necessitated further experiment with propellers to recover the lost speed and climb. The ill-luck that had haunted us in the spring was still in evidence, for a serious accident was only narrowly averted during Ding's seventh flight on July 3rd. The "steamroller" had been up several minutes at a height of 1,500 feet, and was on the point of landing *en vol plané*, when a pupil on a Caudron taxied right in front of him. With great presence of mind Ding switched the engine on again, and had it not picked up immediately the Caudron would have been smashed to matchwood by over a ton of "steamroller" moving through the air at 70 m.p.h. However, he was just able to jump over the "louse," the embryo pilot of which was in great need of a substantial dose of phospherine. On Sunday, July 4th, Ding made his eighth and ninth flights, in the latter of which a very interesting episode occurred. The old "bus" was in great form and travelling at 73 m.p.h. Ding had just passed a "box-kite" to confute a rumour that the Mann was slower than machines of that type, and was banking to turn, when suddenly a shower of objects flew out behind the left rear of the machine and simultaneously everybody on the aerodrome heard a crashing report. At the same time the right-hand propeller was observed to increase its revolutions, but the "bank" grew no worse and Ding switched off, got the machine

at a level keel, and landed without accident. Investigations showed that one of the steel stay tubes supporting the left hand propeller shaft had broken, and falling back into the propeller, had caused it to disintegrate. This incident was really a blessing in disguise, for it demonstrated the utter fallacy of the theory that any accident to one of the propellers of a twin-propeller machine must inevitably "crash" the "bus."

A fortnight was spent in making a new propeller and strengthening up the propeller brackets, and on Sunday, July 18th, the "steamroller" was again pushed out. Jupiter Pluvius had been busy during that fortnight, and the whole machine had been saturated with water which had percolated through the roof of the tent. The result of all this soaking was a shocking attack of "non-starteris" on the part of the "starfish," which was not improved by the confusion of high tension wires 6 and 9 by a careless mechanic. The figures on the Anzani crank case, it transpired, were to be read upside down, which is somewhat embarrassing. M. Hagons, the Anzani expert, seemed greatly amused at our confusion of 6 and 9. During the following week short flights were made on July 19th, 20th and 21st, but trouble developed with both the petrol system and the air speed indicator, which restricted us to 10 minute flights at an alleged speed of 50 m.p.h. On the last day of July and August 1st some more or less "dud" flights were put up, and then Ding returned to Windermere in disgust, having flown the "bus" altogether about three hours.

Having in the meantime secured that *rara avis*, a petrol pump that pumps petrol, we induced Mr. Sydney Pickles to try the machine on August 4th. For once in a way the "steamroller" was on her best behaviour, and climbed without any forcing to 3,000 ft. in ten minutes, remaining in the air the record time for her of half an hour. On the following night, Thursday, August 5th, Pickles took up Mr. Mann as passenger for an hour's flight, climbing the first 5,000 feet in less than 20 minutes. After the transmission gear had been overhauled and found quite satisfactory, Pickles took up the writer on August 21st, and Mr. Jones, of "FLIGHT," on the same day. The climb had by this time been increased to 500 ft. per minute and the speed to 75-80 m.p.h. All our troubles seemed to be over, and the machine, now highly successful, was about to be re-offered to the Government when the thunderbolt fell. Pickles was forbidden by an American firm, with which he had just completed a contract, to fly any machine but their own particular make. The fatal day was August 22nd. Pickles had flown the "bus" almost as long as Ding, i.e., 3 hours.

A weary, discouraging wait ensued, for it was not until October 2nd that we were able to secure another pilot in the person of Mr. A. E. Barrs, invalided from the Royal Flying Corps. All the intervening six weeks the poor old "steamroller" was steadily deteriorating in our damp tent, the fabric getting slacker and slacker daily, and rust collecting on all the metal parts despite paint and grease. After two excellent preliminary flights of 18 minutes and 9 minutes respectively, during the second of which he carried a passenger, on the following day, October 3rd, he ascended with another passenger to the height of 5,000 ft., but as the weather was misty he decided to go no higher, and remained at that altitude for 40 minutes. After tea he took up a third passenger for 15 minutes and performed some astonishing evolutions, including heavily banked right and left-hand turns with hands off the controls, a feat that the exceptional stability of the Mann biplane renders quite easy. During all these flights the "steamroller" attained a speed of 80 m.p.h., which at that time was a record pace for a two-seated "pusher" machine, and surpassed by very few two-seater "tractors." Unfortunately, after landing and taxiing some distance, the wheels became embedded in a filled-in trench, with the result that the chassis and one propeller were broken. This, however, was in no way the fault of the machine. We had a lovely job getting the "bus" to our tent in the dark. To lift a dead weight of over a ton on to a trolley at night with only six pairs of hands and no mechanical appliances is "some" feat. Still, it was done with much pinching of fingers and uttering of strange oaths, and we "teedled" the trolley for home with one mechanic leading the way as guide and steering by the stars, a task for which his former experience in the Navy would seem to render him specially suitable. After we had been pushing and shoving for half an hour or so without any sign of the home fires in the tent, the ground seemed so very familiar that we stopped to investigate. Enquiries showed that our guide, who had that day been treated to a special "joy" ride in the "steamroller," had been celebrating the occasion to such an extent that he had been travelling in a circle. On being remonstrated with by the foreman, he immediately took