

House Dinner.

THE second House Dinner of the Institution was held at The Engineers' Club, on 4th March. The function was well attended, and a very interesting and enjoyable evening was spent. In the unavoidable absence of Colonel Moore-Brabazon, the Chair was taken by Mr Lawrence Wingfield. The main points of the speeches in the discussion were as follows —

The CHAIRMAN. We were expecting to have heard Captain Courtney to-night on the subject of the Auto Giro, but unfortunately he is unable to be with us as he is still feeling the effects of his recent accident. Mr Bramson has very kindly consented at short notice to take his place, and asks me to say that he hopes you will excuse him if his words seem a little impromptu. I am certain that you will listen to Mr Bramson with the keenest interest and pleasure, because not only is he an expert speaker, but he knows his subject backwards.

Before calling upon Mr Bramson I should like to refer to the question of the proposal for amalgamation of our Institution with the Royal Aeronautical Society which will shortly be placed before our members. You all remember that about eighteen months or two years ago a similar proposal was put before the Institution. The proposed terms for amalgamation on that occasion were such as would appear to swamp the Institution entirely, they provided for only two members of our Institution on the Council of the combined body, and the grading was in some doubt. The Institution, largely under the ægis of Dr Thurston, very rightly turned the proposal down. Things then commenced to move very rapidly, and the day has now arrived when we who are interested in aviation see the results of the bad years we have gone through. We are seeing the results of the propaganda we have been doing, and that aviation is becoming a matter of public interest. That is one of the reasons why the Council of the Institution have thought it desirable to reconsider this question of amalgamation. Very shortly the terms for amalgamation will be put before you in the nature of a referendum, and you will be able to consider them and form an opinion upon them, but I can say this—that there are five points about these terms which are quite different from those of two years ago. The five points are these —

(1) The name of the Institution of Aeronautical Engineers is to be retained. We consider, of course, that this is of the greatest possible importance.

(2) When the amalgamation goes through, the Members of the Institution will have the option either of retaining that title or of becoming Fellows of the combined Society, and Associate Members will have a similar option in regard to Associate Fellowship.

(3) There will be no increase in subscriptions and no additional entrance fees.

(4) The Council of the amalgamated body will consist of not less than seven members of the Institution at the outset. What the Council consists of afterwards entirely depends on the members of the Institution within the combined Society. Judging by the enthusiasm shown by our members during the past

year I have no doubt that within the amalgamated body they will form a most important and energetic nucleus

(5) A Rules Committee is to be set up, consisting of two members of each Society under an agreed Chairman, to work out the actual details of the amalgamation

I mention this to-night because it has already appeared in the press with a certain amount of adverse criticism. One particular section of the press said that it was an example of the Aeronautical snake fascinating the Institution rabbit. I think similes are dangerous, and anyone who calls the Institution a rabbit risks being flung out, so I hope that remark will not be repeated. I can assure you that the Council of the Institution has not approached the subject in any sense of hypnotism. The Council have felt that they were working in the sole interest of the aeronautical industry as a whole, because they think that with the amalgamation there will be a far greater amount of money available for all the purposes for which this Institution needs it. They feel that the Institution is flourishing, and that when the amalgamation is through we shall be controlling the Aeronautical Society rather than them controlling us. It is with the growth of aviation that the need of one combined body becomes pre-eminently necessary.

Continuing, the Chairman said: I have now much pleasure in calling upon Mr Bramson, who is going to open the discussion at short notice because of the unfortunate absence of Captain Courtney. Mr Bramson will speak on the Anti-stall Gear, of which you all know him to be the inventor. Many of us regard the anti-stall gear as being probably the one thing which is likely to make aviation safer in the near future. At any rate, the Council have thought it of sufficient importance to merit the award of the Sir Charles Wakefield Medal, which will be presented to Mr Bramson on the 31st of this month. The Sir Charles Wakefield Medal is given for an invention or apparatus tending to make flying safer, and it was with the intention of bringing that special thing into prominence that the Council decided that the Medal should be awarded to Mr Bramson. I now have pleasure in asking him to speak to us.

MR BRAMSON: I asked Mr Wingfield to make an apology for me, and he made it rather worse than better by his kind remarks. I might say that when one happens to be a substitute one tends towards becoming apologetic. However, apologies are boring things, and I won't inflict more on you, though the tendency is perhaps more excusable in view of the fact that the person for whom I am substitute is one so brilliant and famous. We all wish him a speedy recovery, and I hope that the pleasure of hearing him here amongst us may be only a pleasure deferred.

I trust it will not be out of order for me to refer, as our Chairman has done, to a certain press article. Mr Grey not only referred to the Institution as a rabbit, he also repeated that much quoted and much abused expression that "competition is good for trade." Unfortunately, that statement can be very misleading, but I think there are few people who can be found to maintain that competition is good for the weakest competitor. That is to some extent our position, and therefore, with great respect to the writer of the article, I do not think the argument applies

Coming to the subject of my talk to-night, when speaking about one's own work it is very difficult not to be under the painful impression that one is trying to boost one's own goods. I trust you will absolve me from any such intention, because what is the use of ever producing or trying to produce anything successful if one does not go one step further and try to convince people (and, in this particular case, the "man in the air") that it is a good thing, or, at least forcing him to prove to you that it is not? It is on that basis that I ask you to forgive me for talking about my own work. In that connection I think I ought to make reference to the very great honour that the Institution has conferred on me. I consider that the personal honour is a matter of relatively small importance not to me, but to the aeronautical community. The thing about it that does matter is that a serious responsible body of people have expressed it publicly as their view that certain serious accidents can be prevented and lives saved if a certain course is taken. That, I think, is the real value of any such action as the award of the Medal.

I would like to draw your attention to this fundamental point—that any safety device must be inherently unpopular with the victims on whom it is going to be inflicted. It makes the problem of life saving and the invention of safety devices for aircraft, an extremely complex one, because after solving the mechanical problem you are up against a psychological problem, which, being vague and inexact, is far more difficult of solution, and I shall be very much obliged for any suggestions for a happy and complete solution that may be made later on during the discussion.

Let me now come to the subject matter.

Before talking about stalling—intentional or otherwise—it is necessary to define stalling. This has generally been referred to as a reduction of speed beyond a certain point. That is inaccurate, because any machine will stall at different speeds, dependent on the loading. The one thing which is constant about a machine in this connection is the incidence at which the machine reaches its maximum lift coefficient. I say "the machine" deliberately, because the wings alone are not the whole criterion, therefore I will for the purpose of these few remarks define stalling as the attainment of the incidence corresponding to the maximum lift coefficient of the machine, that is to say, the attaining of the incidence which, if increased, causes a decrease in the lift coefficient, and if decreased causes an increase in the lift coefficient. In other words, when a machine is stalling it causes a decrease in the lift coefficient.

I am deliberately avoiding reference to the question of loss of control or otherwise, as we all know about modern developments such as the Handley Page slotted wings, etc., where special designs of control surfaces make it possible to fly without loss of control, but that is still stalling, and no manoeuvrable machine will ever be made which cannot be stalled—though it need not necessarily lose control.

Just for a moment consider what are the means at present available for a pilot in a machine not fitted with the Anti-stall Gear. He can notice—if he searches for it—the abnormal sloppiness of the controls. That is a very inexact method, and in a heavy machine it does not convey anything. Or he can notice his fore and aft lever in relation to the centre. Again, that is only a vague indication. Or else there is

the air speed indicator. Even that will not tell him how near he is to stalling, because he cannot know with the necessary accuracy, what his loading is. Therefore, the fact remains that there is no accurate indication on a machine, of a very closely approaching stall.

Of course, in practice one flies without stalling, that is due to the fact that the machines are so devised that they cruise too far from the stalling point, except in certain circumstances. Then there is sudden engine failure and inertia effect. There is also the angular moment of inertia of the machine round its transverse axis, which prevents it taking up the right attitude. In this case the machine will not provide against stalling, and a stall may occur without the pilot suspecting it. The important thing is that pilots, whether experienced or inexperienced, do from time to time kill themselves in that way.

Referring again to the air speed indicator. To my mind this can sometimes give misleading information. Assume you are gliding down at a perfectly safe air speed without engine on, and that for some reason or other you pull the stick a little backward. The machine then slows down, but as you have a large margin of air speed it will not slow over stalling speed. You may glance at your air speed indicator and it may give you a reassuring reading. Maybe you have to pull that machine into horizontal flight, and as it is horizontal flight without engine on, there will be deceleration, though the air speed indicator will give a safe reading. You therefore think that all is well, and meanwhile do not change your controls at all. It is quite possible that the machine may fly horizontal for about ten or twelve seconds and then be stalled without any manoeuvre on your part at all. There is an obvious case where a pilot should be definitely told that he is *about to stall*. It is no good relying on something which demands from him that he has to enquire *whether he has stalled*, because there is no guarantee that he will so enquire.

Referring to the Christmas Eve accident at Imperial Airways in 1923, I think that was an accident which, just for the reason that it was Imperial Airways, shocked everybody who is really keen on aviation. I tried to worry out what it was that was fundamentally wrong. Why should such a thing happen, and why can the whole of that wonderful machine be plunged into destruction due to an oversight? I tried to analyse it, and came down to the fact that it is a physiological problem. The pilot is in danger, and has to be told he is in danger, because in those circumstances where accidents happen he is not aware of the danger. Pilots never stall deliberately.

In considering the type of warning required we must remember that we are dealing with the human element, and we must therefore appeal to one or more of the five senses of man. Of these, sight, hearing and touch are the most suitable.

Sight has been tried by means of red lamps galore, air speed indicator, etc. That is not enough, because no visual scheme can be produced which will catch the pilot's eye in the direction in which he is looking, therefore it may not reach him.

Hearing has been tried at Farnborough, but it is likely to have the effect of *frightening the pilot and making him see the wrong instead of the right thing*. Moreover, in noisy machines it may not be heard.

We then come to the sense of touch, which is the only sense you can appeal to with infallibility. If you get the correct result with regard to touch, it lies very near to making it an impulse in the direction in which action ought to be taken, and at the hand which holds the joy stick. That is a point where the pilot is in constant sensitive touch with his machine, and the problem was to make definitely sure that the warning would always occur at the right moment. As I said at the beginning, the critical value by which stalling is defined is that of the angle of incidence, therefore, the stall detector has to function in the direction of the incidence.

The vane was arranged to move through an angle of 67 deg, and put itself in such a position with reference to the chord of the wing, that when that chord of the wing is at an angle to the horizon equal to the stalling angle, then the vane is horizontal. That means that under normal flying conditions the air will strike the vane at the top and the air will rest against its bottom stop. When you get to a smaller angle than for stalling, and when the incidence is greatly increased, the vane will be horizontal. The slightest increase beyond that will cause an upward lift on the vane, which will start moving upwards. It then increases its own incidence and moves right up to the top stop. There you have a small aerodynamic system which definitely reacts to a predetermined angle, which would be an angle slightly lower than stalling angle. One had to therefore so arrange it that movement caused the warning to occur, and the simplest way would be to do it electrically—or pneumatically, and the little vane would have an electrical stop.

As a pilot I was determined that there should be no faults to which a pilot could object. That is one of the objections to anything that is at all calculated to take the control out of the pilot's hand, therefore the force was to be of the order of 7 to 10 lbs at the hand. That cannot possibly worry you. If you disregard the warning, and stall, then you immediately apply a force and pull your stick backwards and you cannot possibly suddenly apply that force to your stick without knowing that you are doing it. You have therefore a definite system which will give a warning of a close approach to a stall, of such a kind that it can never be misunderstood nor can it possibly fail to reach the pilot.

So much for the particulars underlying the anti-stall gear. Now let me ask, is there any possible reason why, when a pilot is liable to do something which is intensely dangerous to him and his passengers, he should not be told about it? I personally have not been able to find a valid reply to that question, but nevertheless one has found objections raised. The chief objections have been in connection with the landing and take off. Consequently a small trigger release was fitted which with slight pressure of the finger will put the gear out of action. One cannot do that without knowing it, and therefore would only do it when it did not matter. There have been other objections raised, and they have apparently been difficult to reply to. For instance, it has been argued that if, after passing a hedge or trees a pilot wants to either land or crash in a very small field, then he is supposed to know what he is doing, and is deliberately flying very slowly, and comes down and wants to get just over the hedge, and cannot be sure where he is going, then when he is very near a stall he gets the warning, and it will make him pull his nose down.

When you are so near a stall that the warning is given, it means that you are flying at a larger gliding angle than if the tail was stuck a little forward. Therefore, if when you are doing that you get a warning and let your hand forward and diminish your incidence, the result will not be to destroy your chances of getting over the hedge, but to improve them.

The CHAIRMAN. It always seems that the engineering profession has a really refreshing habit. I mean that when a golfer relates his exploits you listen with a sense of polite interest which actually conceals your boredom. When a fisherman tells you his wonderful stories you have great difficulty in hiding your inability to credit the narrative. When a commercial magnet pins you down in the club and tells you the secret of his commercial success, you feel inclined to hit him in the face, but in the engineering profession it is possible for an inventor to get up and talk about his own invention with complete modesty, and in a manner which maintains your entire interest. It is because you know that an inventor is far less concerned than anyone else, with commercialism, and is more completely alive to the achievement of the perfection of his invention. We can sit and listen to an inventor discussing his invention, without feeling in the least degree that there is any suggestion of conceit about it. I may say that as I am neither an inventor nor an engineer. In Mr. Bramson's case he always speaks with becoming modesty. We thank him for having so kindly taken Captain Courtney's place and introduced such an interesting discussion and I will now ask Captain Barnard to speak to us.

CAPTAIN BARNARD. I listened with a great deal of interest to Mr. Bramson's account of the capabilities of his device. In my job one does regard things with a certain bias so far as the civil side of air transport is concerned. The Air Force is paid to be killed sooner or later.

On the other hand, I have a strong feeling that to avoid stalling near the ground is a question that may touch me very closely one of these days.

It has always struck me as remarkable that so many able inventors in the aeronautical profession should devote their efforts to bringing several different inventions to a high degree of efficiency, instead of producing one single invention for each machine.

In an air transport company one is first confronted with a businesslike board whose chief consideration when drawing up a specification for a machine is—how much paying load will it carry, and how far? After having approached the traffic side and got its ideas on pilots, it turns to the mechanical side. After all, the traffic side represents the income and the mechanical side represents the expenditure.

How can the engineer help you to do your job more quickly in the future, and at less expense?

The most inexplicable thing to my mind is that these business boards all over the world do not seem to be able to realise that a sword of Damocles is hanging over their heads. We all know that there might be a bad crash to-morrow, or the week after next, or next month. The utmost that the mechanical side can do is to see that machine, engines and instruments are to the best of their knowledge in first-class working condition. Supposing a crash occurs to-morrow, the papers say

“ That is bad,” and others say “ I told you so , I knew it would happen ” Next week another crash occurs The papers get together and say it is exceedingly serious, that flying is dangerous, and they must ask the Government to close air transport Then a third crash occurs, and the company goes out of business

Mr Bramson has talked at some length about a device which would enable a pilot to do his job with a certain amount of safety We know quite well that the two chief dangers a pilot has to contend with in these days are, first, the results of engine failure, and secondly, weather conditions We know that provided the machine has only to carry a commercial load, three engines are quite sufficient, though it would probably be better to have at least four We also know that there are a number of ingenious devices which will enable a pilot to find his way through any weather conditions There is one particular little section which devotes its attention year after year to the leader cable device, and there is the directional wireless apparatus

What is wanted is for everyone to get together and draw up a specification for a machine which could be flown through any conditions to its destination without forced landings or engine failure That is infinitely more necessary than reiterating the advantages of one scheme or device against another

CAPTAIN SAYERS I am faced with the problem of discussing a question which has been opened by a gentleman who has carefully and precisely explained his somewhat delicate position, and I find it exceedingly difficult to make any objection to what he has said The alternative to agreeing with Mr Bramson is to disagree, and I am faced with the task of finding something to put up against his arguments

The only valid objection that one can make to an anti-stall gear is that anything that you stick on to your aeroplane necessarily makes the machine heavier, and more complicated Therefore, from a designer's point of view the anti-stall gear is objectionable because it does nothing towards flying your aeroplane, but that is no argument against using it if it is really necessary

I think I am right in saying that an anti-stall gear can be made quite unnecessary, and that the necessity for an anti-stall gear arises because in this country (and certain others) the habit of building biplanes seems to be indigenous If you take a normal wing you will find that that wing is unstable at any angle of incidence up to stalling , after stalling incidence it becomes stable If you put one plane underneath the other and stall it, the effect of the bottom wing blanketing the top wing has a very marked tendency to reduce stability after the stall

If you take out the complete conditions of equilibrium for a machine of reasonable characteristics, you will find that using a wing with a small C P travel over the normal flight range, a monoplane becomes exceedingly stable in the neighbourhood of the stall This is really how Mr Fokker obtains the apparent un-stallability of his machines without using gadgets

I happened recently to have to go very carefully into the characteristics of a monoplane as opposed to a biplane, and I found that, without any particular precautions concerning stalled conditions, a monoplane tends to give a normal control over the ordinary flying range, but has a very marked disinclination to stall That characteristic is absolutely and entirely a matter of the angle of incidence , it

does not depend on altitude or speed, you may, in fact, design an aeroplane which will refuse to bestall. With a normal type of wing you can get a machine which controls easily to within one mile an hour of its stalling speed, and in that one mile an hour the control will suddenly stiffen up, and resist further increase of incidence.

Our trouble with stalling is largely due to the fact that we use biplanes, and that interference between wings, together with the small chord employed, washes out the natural tendency of the wing to resist stalling.

We in this country have become rather conservative with regard to aeroplane design. We have standardized aeroplane design with the aid of the finest research organisation in the world. It is unfortunately true that research organisation does not publish its results as quickly as certain others, and seems very frightened to give any information that it has not checked repeatedly.

The practical designer in this country has therefore been forced to design machines of a type with which he is familiar and of which he knows the limitations, and of which he ignores to some very considerable extent, the disadvantages. Would it not be better if he would use a type of aircraft of which the characteristics of the machine itself make for safety, rather than depend on the development of a subsidiary mechanism which could be rendered quite unnecessary by the design of the machine?

In saying that I am to some extent touching on a point which Captain Barnard raised. We have had information lately of many inventions which tend to make for safety in flying.

The leader cable is a comparatively simple thing, and will not cost much to lay. Directional wireless does not cost much more than £10,000 to erect in a single station.

I do think that the aeroplane designer in this country has got to look at the question of aeroplane design from the point of view that the aeroplane is a vehicle which should be able to start out to fly to any required destination quite independent of the ground. That is the one way in which an aeroplane scores over other forms of transport.

Transport at 100 to 200 m p h on a suitable surface track need not be very much more costly than flying at the same speed. But the air has been provided gratis for the aeroplane, and the Almighty has not built the earth with a surface suitable for 200 m p h transport.

To make the aeroplane dependent on an expensive and complicated ground organisation is to sacrifice its one great advantage and to reduce it to railway level.

The aims of the aeroplane designer should be to produce a machine which can safely start from any point and proceed to any other with the least possible dependence on ground organisation or auxiliary gadgets.

CAPTAIN OLLEY. I should like to say that I welcome anything of the kind which Mr Bramson has described, and I am sure any pilot welcomes it.

On one occasion I was able to test this instrument, and I was greatly impressed with its usefulness. In commercial flying one often has to go through clouds, and an instrument of this kind would be a great help. To an experienced pilot a stall

is not serious, but to stall a machine containing twenty passengers is rather an awkward thing, but, as Captain Barnard said, it is a matter of the more you put on the machine in this way, the less you can put on it in paying load

Dr THURSTON There are only two forms of successful invention—one in which you say “What a pity it was ever tried, and the other in which you say “What a pity it was not to try it myself” To a patent agent, the more inventions that are brought out for aeroplanes, the better pleased he is I was therefore glad to hear one of the speakers say that there were many thousands of inventions contributing towards the safety of flying

I feel very strongly that the best aeroplane is one in which you have got the fewest gadgets, and that you should have no gadgets at all on an aeroplane which do not contribute some useful part either in taking the load or helping to get it through the air In other words, we want to keep the structure weight of the aeroplane as near the vanishing point as possible

With regard to stalling, I have had some intentional and some unintentional stalls Mr Bramson says that if you want to reduce speed you may change your downward path into a horizontal or upward path without knowing it, but I venture to contest that statement in a certain degree What has happened to the horizontal? If you are going to land and you see that you have the nose of the machine down properly, you know quite well that you change the attitude of the machine and have it in a position in which a stall is likely Of course, if you are so enclosed in, and require gadgets to enable you to use your eyes as the first sense you have, then it is possible to get the machine into a position in which you may stall near the ground, and crash

The CHAIRMAN I will now call upon Flight-Lieut Reid, who has been awarded the Silver Medal of the Council of the Institution of Aeronautical Engineers for his inventions of the Turn and Reaction indicators

FLIGHT-LIEUT REID I think it is a very great honour to have anything given to one towards helping an invention, and there is nothing more terrible than to be called “the man who invented this or that,” but I do think that in the Institution of Aeronautical Engineers there are so many problems to deal with that it needs the candid advice and criticism of every type of member No inventor can be really commercial unless he gives service, and no invention is ever perfect No apparatus fitted to an aeroplane will stay long if it does not do some useful work, and the result can only be judged by statistics

I only designed a certain invention because I had to do fog flying in the North Sea, and got very tired of it I want to try and do something to help, but there is no perfection yet, and it needs quite a lot of experimental work It is for the people who have tried these devices to say if they are useful

With regard to an anti-stalling device, this really seems necessary, because so many people are killing themselves by stalling The next question is, what description of apparatus will suit the aircraft designer and the pilot? The main

consideration is weight, which is the main consideration in aircraft design of any kind, as we want to get the best possible performance with the very least weight

In 1920 I was trying to work out the control of aircraft from the control indicator, and I would like to suggest to Mr Bramson that even though it may be turned down by experimenters, it is well worth going on with the solenoid idea, because to-day you get a make which weighs one pound. It will use very little current, and that may be indicated by a little lamp on the dash-board. That may help to influence those who would like a lamp or a flick of the stick. The intention is to consider the question of safety, and I personally think that it is absolutely a practical scheme provided the machine carries a small accumulator, all aircraft have to carry these now. I think it is worth trying, and will help the designer in cutting down the weight, and it will be interesting to get the opinions of the pilots who try it.

I should like to say in conclusion that I have been very grateful to all the practical men I have met in the aviation world, for all their criticisms and hints, and I would particularly mention Captain Barnard. Even to-night he gave me some criticism which I am going to work on, and I think that is the spirit which will make this Institution the paramount Institution in aviation. It ought to come to the day when it takes its place with the Institutions of Civil and Mechanical Engineers, etc.

Mr C G GREY. As the criminal who likened this Institution to a rabbit, let me say that when the Institution is absorbed by the Society you will be able to console yourselves very much on the lines of the gentleman who remarked that when the whale swallowed Jonah, it had more brains in its stomach than in its head.

I should like to disagree with everybody on general principles.

First of all I do not disagree with very much that Captain Barnard has said on the subject of big air transport firms. Anybody who is going to run a successful air transport show ought to bring the pilots into consultation before he does anything else, find out what they want, and judge them individually. Put them up against one another and you will get something like perfection.

The only point on which I feel inclined to disagree with Captain Barnard is his love for the multiplicity of engines. That can be overdone, and it is not going to give you absolute infallibility. You may be in such a position that if it was essential, your third engine can carry on, but you are never free from the possibility of something happening which compels you to come down at once, say an airscrew breaking and ripping the fabric, or, if you have an all-metal aircraft, letting the air into the wing. Such things may happen, and consequently it is very important to have something which will tell a pilot that he is near the ground if he is just on the verge of stalling. Dr Thurston's plan of watching the horizontal is not always practicable. His objection to the anti-stall gear on the ground that it is going to upset your stall just when you want to, is pure nonsense, because you can set the stall indicator to give you just as much kick in the handle as you want.

Captain Sayers said that a solution of the trouble would be to have a wing that won't stall. Well, I am like the old lady from the country who, when she saw a giraffe, said "John, I don't believe it." I do not believe for a moment that Mr Fokker's monoplanes do not stall, because of the wing, the chief reason is that they have a long fuselage and any amount of control over it.

COMMANDER ATKINS. The thing that impresses me chiefly is the commercial point of view and the naval point of view. To me, a stall means a defective machine or defective pilots in some way.

With regard to the pilot, one of the things I first remember in the Navy was a certain device to indicate what the ship ahead of you was doing in formation, and that kind of thing becomes mechanical. Instead of using their own brains they were not there doing the job, they depended on mechanical things, and if those mechanical instruments failed, you might lose the ship. You were not developing your sea sense to the greatest extent you could, and I think that might apply to a certain degree to pilots, though it may be necessary to use every means possible to prevent a stall. Regarding Captain Olley's remarks, it certainly appeals to me to have some device to allay the fear of the passengers.

MR HULBERT. I have recently had an opportunity of flying a machine fitted with the anti-stall gear, and there are one or two points which rather impressed me.

Dr Thurston referred to the weight of the gear. That weight is something under six pounds.

With regard to stalling near the ground, if you cut out the anti-stall gear by means of the trigger, you can fly the machine as an ordinary one, and the control is not affected.

Another point I wish to mention is this—it was stated that the invention was being taken up abroad, but had not received much attention in this country. Perhaps in replying Mr Bramson will tell us of the popularity of the anti-stall gear abroad.

MR BRAMSON'S REPLY TO THE DISCUSSION

It is very gratifying to me that, whether you agree or not, you have had so much to say. That is generally supposed to be the proper test of whether an evening such as this has been worth while.

Captain Barnard talked as he always does, but in an intensified form to-night I have rarely heard it stated so concisely and clearly as to what the technical people concerned with aviation ought to do. One might say that the right body to deal with the various problems would be the Institution of Aeronautical Engineers, and in fact they do do it to the greatest extent possible, but looking at it from the official standpoint, I think the nearest one to us to-night would be Captain Tymms, and I therefore put it to him that any efforts he might exercise as the result of the discussion to-night, would be very well spent.

Captain Sayers referred to the weight of the gear. That, of course, is relative. In the case of the anti-stall gear, the added weight is equivalent to the difference between a heavy and a light overcoat on the pilot. When you consider what you get for that same weight it seems to me a fair deal. Apart from that, Captain Sayer's solution of stalling problems by choosing monoplanes instead of biplanes, has several possibilities. Assuming that Mr Grey is wrong in saying that he does not believe it, one of the possibilities is that it can be applied to existing biplanes. Another possibility so far as my knowledge goes is that for load-carrying capacity the monoplane is heavier than the biplane.

Captain Sayers mentioned one particularly interesting point—that some aeroplanes completely refuse to stall. One would first of all reply to that, that they can only do so by having defective manœuvrability at stalling point. The warning which the pilot is supposed to be getting through a greatly increased force on his stick is not really a warning, because it has been suggested that it would be better to have a greatly increased force. The objection to that is that there is no means for the pilot ascertaining when the strength of that force constitutes a warning. That to my mind is the reason why you must have something sudden and critical happening, to show that a stall is about to occur. That reminds one of Dr Rohrbach's solution of the stalling problem, which practically consists of a gadget which makes it impossible to stall. Just before stalling incidence is reached you can pull your stick right back, and it does not pull the elevator out any more. One had the good fortune, when in Germany, of being able to compare the anti-stall gear with Dr Rohrbach's system.

When listening to Dr Thurston with regard to his profession, one could not help thinking that perhaps it was a mistake, at the time the anti-stall gear was originated, not to have him as patent agent. I would very much dislike trying out any more manœuvres recommended by Dr Thurston and referred to as stall landings.

Flight-Lieut Reid referred to the anti-stall gear in extremely judicious and wise terms, and he also mentioned the very great need for further experiment and I shall, with his permission, call upon him to co-operate with me, because I have had it put up to me in connection with the American Government, and any advice that Flight-Lieut Reid may be able—and probably willing—to give me on the subject of the design of his gear, I shall be very pleased to have.

Mr Grey said something eloquent with regard to a multiplicity of engines, and his main argument was that even if engine failures are arranged not to matter, other failures will occur. It seems to me that the proper reply to that is, do they, in fact occur? I think the proper answer is in the examination of statistics. Mr Grey thinks that propellers might fly off. They might, and the wings might break, and locomotives wheels might drop off, and so on, but do they? (Mr GREY: Yes, they do.) Is it politics to adjust the design of aircraft to deal with these extremely unlikely and rare occurrences, which would only reduce the safety and reliability of flying to the same order as other forms of transport? It seems to me that if you can deal with engine failure and bad visibility, flying will rank in safety and reliability with the other forms of transport.

Commander Atkins mentioned that monoplanes can be rather awkward in the Navy unless the wings were removable, but he also mentioned a thing which is quite as common in the anti-stall gear or other instruments, namely, that pilots should not depend on the various instruments. No one suggests that they should depend on them. The idea of the anti-stall gear and other devices is that they should be there as a sort of insurance policy that will save you in the nick of time should the need arise.

Referring to Mr Hulbert's very kind remarks, I can only say that the French rights have been disposed of, and they now intend to take it up seriously.

In conclusion, I would once again offer my hearty thanks to you all for such an interesting discussion.

The CHAIRMAN It is now my pleasant duty to ask you to accord a hearty vote of thanks to Mr Bramson for filling in the gap as he has done to-night.

Mr HULBERT I am sure Mr Bramson would not have opened this discussion unless he had been asked, and as it was our Chairman, Mr Wingfield, who asked him, I think our thanks are due to him, especially as he put off another appointment to come here to-night.

The votes of thanks were passed with acclamation, and the proceedings closed.

Institution Library.

Members are informed of the following additions to the Library —

“ Commercial Air Transport,” by Lieut -Col IVO EDWARDS, C M G ,
and Captain F TYMMS, M C

“ The Great Delusion,” by “ NTON ”