TEE EMM

Number 11 February 1942

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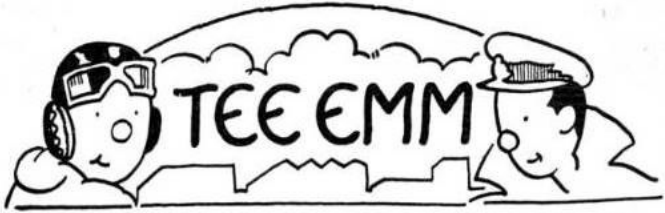
Pilot Officer Prune says— "Take Tee Emm regularly! Prevents that 'Thinking feeling!'"



I hope that these Training Memoranda will be widely read and studied, since I am certain that they will help us all to improve our efficiency, not only in our training but also in operations against the enemy.

Air Chief Marshal, Chief of the Air Staff

TEE EMM FOR FEBRUARY

EVER done a jig-saw? You start by emptying all the pieces out of the box and turning them right side up. What have you got? A hundred little bits of an unknown picture—each useless in itself, each by itself unintelligible. You can give every person you meet one of the pieces—and you'll be giving him something of no value at all.

Now forget your jig-saw pieces. Lots of other things—such as casual pieces of conversation—are of no value at all. In war-time, of course, certain bits of information are of value to the enemy, but you never give him those! Nor, we hope, do you ever give bits of information that are of value to the enemy to anyone, even to friends—because bits of information have a habit of getting round. They are overheard, and repeated; letters are left lying about and read by other people; and so on. No, if ever, by any chance, you *do* give any bits of information—just to make conversation, or because they may interest your friends, or because they show you in a good light—you take great care that such bits of information are quite valueless. Of course you know they can be of no *possible* use to the enemy, or you would never, *never* let a word pass your lips. Just harmless conversation.

So far, so good. Here are some harmless little conversations.

Mrs. A——, the wife of an airman in a maintenance unit, chats to the milkman: "The milk rationing doesn't worry me so much now. My Tom is away from home

three nights a week. Has to sleep on the Station, as there's some rush job on, fitting a lot of aeroplanes with some new thing that protects them against cold. But, of course, he won't tell even *me* anything : he knows how to keep his mouth shut."

Sergeant B——, a pilot, is home on embarkation leave and to say good-bye to his fiancée. He says : " Can't tell you where I'm going, Kitty, but you might finish off that warm jersey you're knitting for me, if you can do it in the next few days. And anything else in that line. The Admin. Officer tipped me off that I'd do well to collect up a few things for really cold weather."

Flight Lieutenant C——, having a drink at the Savritz with a friend from another Station, says : " Mind you, old boy, I don't know anything *officially*, but the other day I just happened to see a signal on the Adjutant's desk, when he was out of the room, saying that the wing was to be ready to embark in the near future at Port Reaviemouth up in Northumberland. So maybe this is our last drink together for some while. . . . Well, not quite *last*, old man ; as you say, what about the other half?

Young Mrs. D—— has a husband in the Navy and is talking to her mother in a teashop : " I know being a sailor's wife isn't easy but Jack has only just *seen* baby for the first time and now he's been rushed North again on convoy escort. He won't tell me anything, but you know what *his* ship is, so it looks like an important job."

Mr. E——, a clothing manufacturer, over lunch in his club, says to his companion : " Say what you like, this war has made our workers put their backs into it. They're a good lot and they get down to things. Why only the other day I had a rush order—3,000 special thick R.A.F. greatcoats to leave the works by 20th at latest. And those lads with very little experience got down to it like Trojans. We finished the lot to-day with a day and a half in hand. Damned good effort."

A.C.W.2 F——, on the 'phone to the boy friend says : " Do you know we had four Russian Officers in the Mess and I was on their table. Ever so handsome one of them was. . . . Now don't be jealous. Why when he talked in his own language it was all I could do not to laugh—sounded ever so funny. And he's off soon anyway. Liaison it was, or something, they were here for. . . . Oh, go on, I wouldn't fall for a Russian really. . . . Well, bye-bye. . . . Usual place to-morrow."

And G——, a merchant seaman, holding forth in the Sailors' Rest, says : " I don't know where I'm going this time and I don't ruddy well care. Since September, 1939, I've been to Rio, Shanghai, Singapore, Sydney, the Dunkirk Regatter and Gawd knows where else. But any time I can get near enough to have a crack at the perishers I'm 'appy. And mebbe I will this time. ' Mac,' says the old man, ' I'm saying nothing, but if you like vodka maybe you'll soon be able to get some.' So long, then, old cock : after Thursday you'll 'ave to expect me when you see me."

Just harmless little conversations, all of them. But enemy ears are everywhere. Who knows that each conversation did not come to an enemy ear and an enemy mouth tell them to a controlling enemy mind.

So here, then, is our last conversation :—

Herr Commandant H—— says to a colleague : " So what do we know now from all these agents' reports ? Aircraft at Z—— station are being fitted with some

special protection or other against excessive cold, and it's a rush job. Aircrews on embarkation leave have been advised to provide against a very cold climate. A whole Wing is shortly to be embarked at Port Reaviemouth and that's in N.E. England. A strong escort is also wanted up north for an important convoy—probably the Wing. A large consignment of thick winter clothes for the R.A.F. is to be ready by the 20th. Four Russian officers are at Y—— station, on liaison duties. And lastly, a merchant seaman, who is going on convoy to a place where vodka is available, is leaving on—the 23rd. Right ! An R.A.F. wing, heavily escorted, is leaving Port Reaviemouth for service in Russia on the 23rd. If they take the direct route they should be *here* by the 25th ; if they go North they should be *here* by the 26th. So, if we have a strong air force and U-boats patrolling between these points from the 24th onwards—well, we may be able to thank all our kind informants very much."

Back to our jigsaw. Every little bit is still valueless by itself. But—ever done a jigsaw ? You do it by fitting every little bit into a complete picture.

SHAKESPEARE AT AN F.T.S.

Portia pleads for Justice to the Oxford

" The quantity of Oxfords that are pranged
Increaseth as the swelling flood of forms
Upon the multitude : it is twice waste—
It wasteth him that makes and him that mars.
'Tis write-off after write-off : it destroys
The Nation's effort better than the Hun :
Its spectre haunts the scene of aircraft crashed,
A monument to pilot's carelessness,
Wherein is found the chiefest cause of prangs.
Good flying will o'ercome this awful loss :
It is enthronéd in the hearts of men
It is an attribute of birds themselves
And human power will then show most like birds
When flying knows perfection.
Therefore, lad,
Though training be thy plea, consider this—
That, in the course of training, none of you
Need see prangation : you do pray for training
And that same prayer should teach you all to keep
The means of training. I have spoke thus much
To advocate more justice to thy craft,
Which, if thou follow, quick acquiréd skill
May quicker bring our vengeance on the foe."

THE SWIFT TRAINING RIFLE

SOME psychologist or other called, we think, de Grote (P.O. Prune says No, that's a violinist) had a " Theory of Play." He said that the reason that young animals played was that they were really practising for the more serious business of life, getting food, fighting, and so on. The kitten chases a reel of cotton by way of working up into the mouse class, or pads at a blind-cord as practice for the future swatting of a rival in the fields of love. . . .

All this doesn't seem to have much to do with the Swift Training Rifle, does it ? Frankly, we don't think so either. Still, if you look upon the Swift Training Rifle as a plaything to help you in the more serious business of life—at the moment killing Huns—you won't be far wrong. And when we add that it is a rifle which instead of firing bullets when you press the trigger, momentarily projects two sharp pins out of the nozzle, and that if by any chance someone you don't like is in front of you, and happens to be bending down—well, what we mean is you can see it can be a very amusing plaything indeed. . . .

" What would you do, chum ? " asks P.O. Prune.

But perhaps we'd better get on with telling you about it, as it is now being universally supplied to Stations for the instruction of both officers and men in correct rifle aiming.

As the idea of the Swift Training Rifle is to teach you to use a service rifle, it is naturally as much like the latter as possible. It has the same weight and balance, the bolt is handled in the same way and—except for the fore-end—it is the same shape ; there are the same two trigger pressures, and the sights give the same view. All that, so to speak, is the Swift Rifle's " straight role " : now for the " character part "—designed to note and check the various faults in shooting.

The complete apparatus consists of the rifle and a frame, holding paper targets of different types, the rifle muzzle being kept an exact short distance from the target by means of a parallel metal bar to which the rifle is loosely attached by a hook under the rifle stock. The ends of this bar are bent round and fixed to either side of the target frame, but not rigidly fixed, so that any wobbling of the rifle is at once communicated to the target. Thus, to begin with, you learn to keep the rifle steady while aiming. Next, there is a spring butt-plate protruding an inch or so out of the butt which, unless completely pressed in, locks all trigger action. If, therefore, you are not holding the rifle correctly and firmly to your shoulder, it won't fire.

The actual shot is recorded by a pin

which at the moment of firing shoots forward, pierces the paper and immediately recoils. As it is centred exactly along the sighting line, the centre of the little round hole made shows whether you have taken correct aim or not. Parallel to this central pin about a half-inch away on the right, and working with it, is another which has a flat spear-headed point, the flat side horizontal to the horizontal axis of the rifle. This pierces the paper at exactly the same time but naturally it makes a tiny longitudinal slit. This, if the rifle is correctly held, is dead horizontal; if, however, it has been tilted while aiming, the slit will be inclined up or down. By this yet another error in sighting can be detected.

And finally, the pins themselves stay embedded in the paper for the fraction of a second, so that if you haven't held your breath while firing, the round hole will be elongated; if you move, or jerk, or pull rather than squeeze the trigger, the edges of the hole will be torn. In other words, it shows whether you keep properly motionless at the moment of trigger release and just after.

Probably this is the best method yet devised of recording and deducing nearly every possible fault that can be made with a rifle—short, of course, of cleaning someone else's by mistake! All the above and more—appears in the official instruction for using the Swift Training Rifle. And don't forget that if there *is* anyone you don't like, and he *does* happen to be bending down, and you *have* a Swift Training Rifle handy. . . . But we mustn't put ideas into your head.

THE MILITARY GRID

"SUCCESSFUL operations on land depend more than ever before on the closest co-operation between aircraft and troops on the ground."

The above is an extract, and a very true one, from the Despatches of Viscount Gort after Dunkirk. It is, therefore, perhaps a little unfortunate that the R.A.F. (except for the Army Co-operation units and certain units working with the Navy) and the Army each have a different method of describing places on a map. At the same time it is unavoidable. The R.A.F. base their position references on latitude and longitude because of the long distances they have to cover in a single operation. The Army use a system of squares (known as the grid) because the area in which any particular formation of troops can operate at any time is relatively so small that that part of the earth can be taken as being flat. Their idea is that calculations between the gun and the target can thus be worked out quickly and simply: for few of us are prepared to undertake spherical trigonometry at short notice under a hedge—and probably under shell-fire as well.

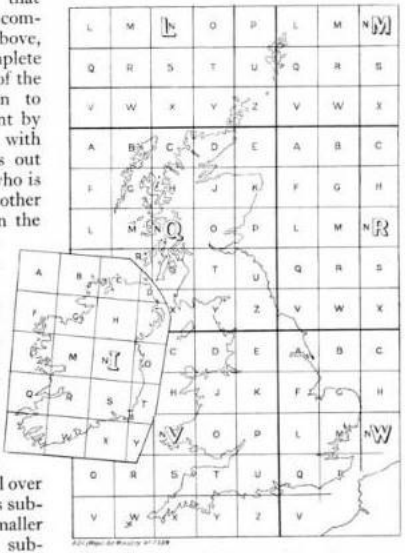
Now it is always possible that those of you in the Air Force who have had no previous experience of it may find yourselves suddenly confronted with a military grid reference. This may occur during a "grave emergency" (Whitehallese for invasion) or at any time when

operating overseas. For you must remember that not all the areas in which the R.A.F. are, or will be, operating are covered by special air maps. There are none, for instance, for the Caucasus, Syria, Iraq, Cyrenaica, or Egypt. The only maps available for places such as these will be provided by the Army ; and Army maps are always gridded.

Further, it is highly probable that future big-scale operations will be " combined operations." Since, as said above, the Army cannot function with complete success without the closest support of the R.A.F., it certainly cannot begin to operate offensively on the Continent by itself. The R.A.F. will be in it with them, and, as in ninety-nine cases out of a hundred, it will be the Army who is asking you for help, and not the other way round, it is up to you to learn the language which the Army speaks when it gives a position reference on a map.

The Army reference system is extremely simple and ten minutes' study of the problem, followed by half an hour's practice, should put anybody on top of it. Start the ten minutes now !

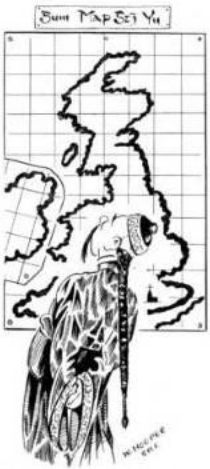
The Military Grid (as you see in the diagram, which shows the grid on England and Scotland) is a system of lettered squares marked all over the area concerned. Each square is subdivided into tenths and each of the smaller squares so formed can again be subdivided into tenths—in your imagination, if not actually on paper. The big lettered squares are bounded by sides of 100 km. and the first subdivision is therefore composed of squares of 10 km. sides. Within a square of 10 km. the position of a point is estimated to the nearest tenth of a side, or kilometre. Thus, by referring first to the letter which denotes the big square in which the point lies and then by giving a distance in kilometres East and North from the S.W. corner of that square, you can locate the point required to the nearest kilometre, on ¼ inch to one mile and smaller scales.



Here's a practical example : Suppose you want to find the grid reference of *Canterbury Cathedral* (don't ask *us* why !) shown on the ¼ inch to 1 mile map of Great Britain (Military Edition) sheet 12.

Begin by finding the letter of the 100 km. square concerned ; in this case " R." Then, *first* give the distance East of the S.W. corner of the square : it is 50 km. + $\frac{9}{10}$ of the side of a 10 km. square, and that is 59 km. *Next* give the distance North of the S.W. corner : that is 76 km. The grid reference of *Canterbury Cathedral* is, therefore, R5976.

Because the R.A.F. reference system means reading latitude before longitude you may fall into the error of taking your Northing first. Watch out for this ! It is vital to remember that it is correct to read first from left to right and then from bottom to top. It is also really more natural—unless, of course, you are Chinese. Always keep this order of reading ! East, then North. " E " in the alphabet comes before " N," and even P.O. Prune knows the alphabet—at any rate as far down as " N."



No can find Canterbelly Pagoda.

Now take the 10-mile map of Great Britain (Military Edition). A sheet of this naturally covers a much larger area than a sheet of the ¼ inch : indeed, if you look at the diagram you will see that the square " R " is repeated five times in Great Britain (and once in Ireland). To direct anyone's attention to Canterbury Cathedral on this, the same reference for the point, *i.e.*, R5976, may again be given, but *only* if he knows roughly the district in which the point is situated. You will notice, however, that on this map the " R " is preceded by a small " w " so that the full reference is wR5976—and this should be given in all cases of doubt. For there are *six* points on the diagram with the reference R5976 but only *one* with the reference wR5976.

Consider now the other side of the picture. On larger scale maps, such as 1 inch to mile, it is assumed that the general area in which references are being given is so well defined that you need not bother to give the main square letter before the reference. (If it is necessary, a small diagram in the margin of the 1-inch map will show you which letter to use.) On the other hand, owing to the larger scale, the reference can, and indeed should, be given more precisely : you can, in fact, use six figures, three for Easting and three for Northing, in your reference. It is the enlargement of the scale which has made this possible ; for the 10 km. sided square, which on the ¼-inch map was quite small, is now big enough to be subdivided again into

ten smaller squares still, and within these smaller squares estimation of tenths by eye can again be made.

Take once more, for example, Canterbury Cathedral (we're being pretty religious to-day !). On sheet No. 117, 1 inch to 1 mile, or sheet 117A, the reference here is 591761. In other words, the difference between this and the reference given on the $\frac{1}{4}$ inch to 1 mile map is that the initial letter has been dropped but one extra figure giving closer definition to $\frac{1}{10}$ km. has been added to both East and North departures from the S.W. corner of the 100 km. square.

We have been talking particularly of the England and Scotland Military Grid, but the same principle applies to *all* grids on *all* military maps, *except* that in maps of certain foreign areas no lettered system is used, three figures for Easting and three figures for Northing being used in its place.

You have already been told that the assumption made in this system is that the earth is flat, but this is only practicable over relatively small areas. When large areas are to be covered another grid has to be started. If you look at the diagram again you will see that this has taken place over Ireland. It is, in short, just as though you were considering a sphere, its face cut, however, into flat facets, each joined at an angle by another flat facet—as on a diamond.

Remember that you must *always* use the grid which applies in the actual area in which you are working. In no circumstances can you " extend the grid " by taking a straight edge and ignoring the existing grid of the sheet you are extending on to. If you do this chaos will reign, and you'll find yourself doing a daylight swoop on Hamburg instead of Stavanger !

The Military Grid in Great Britain is overprinted in blue or purple. In areas abroad where several grids may join one another, a distinctive colour is generally used for each grid, so that you can with safety refer to the " red grid " or the " brown grid," as the case may be. It is not possible, in this short space, to say much about the grids abroad. If you understand thoroughly the system which is used in England and are prepared to tackle the overseas system for an intensive five minutes when you get there, we bet that even P.O. Prune will have no trouble in understanding it.

TEE EMM'S FRAGRANT MINUTE

When the Lord created man, he gave him two ends, one to sit on, and one to think with. Ever since that day man's success or failure has been dependent on the one he uses the most. It has been always, and is now, a case of heads you win and tails you lose.

KEEPING FIT IN HOT CLIMATES

This article has been written for the benefit of those who have recently gone, or are about to go, out East.

P.O. Prune says his *trouble is keeping hot in frosty climates.*

The human body can work efficiently over a wide range of temperatures, and the human race, as a whole, is a fairly adaptable species. Men exist healthily and happily at the Equator or in Greenland, without worrying about the climate one way or the other. But that conditioning has extended over years : you could not suddenly take an Eskimo, plant him in tropical Africa and expect him to flourish without altering his mode of life pretty considerably.

That, of course, is an extreme case : the lucky dweller in a temperate zone can fairly easily adapt himself to hot climates and can live and work there without his heath being affected *so long as* he takes certain precautions. These, however, need not be elaborate and can be fitted into the pattern of his every-day life.

First and foremost here are the three main rules for keeping fit in any hot country.

1. Keep the stomach covered when sleeping or even resting.
2. Keep the bowels active and regular.
3. Do not drink intoxicants before sundown.

Stick to these rules and the hospitals will only know you as a stranger.

In all hot climates certain illnesses are prevalent, and, in the main, can be attributed to three sources.

The first of these is Contaminated Food and Drink. This is the principal cause of typhoid fever and diarrhœa, of which dysentery is a special form, so, whenever possible, eat and drink only from authorised sources. Hot food is safer than cold, and, unfortunate though it may seem, fruit—which should be just the thing in hot climates—is frequently dangerous, particularly rindless or thin-skinned fruits. Melons, for instance, though they have a protecting rind, are often soaked in water by the wily Oriental to increase their weight : the water is probably dirty, the melon gets the benefit—and passes it on to you. Cold meats of unknown origin should be avoided, and so must the accompanying salad and other uncooked vegetables.

Unless you can guarantee the source, milk, water, lemonade, ice-cream and so on are dangerous, and—although they look grand—so are those brightly coloured fruit drinks sold by hawkers or in bazaars. Water can always be made safe by boiling for

five minutes : the best drink is tea with condensed milk. The above should be particularly remembered when troops go ashore at ports on the way out.

Don't forget that, however authorised any food may be, it can be contaminated in a few minutes by flies using it for practice landings. Keep a swatter handy at meals and shoot down all flies before they can come in.

The second cause of disease is Insect Bites. Here the mosquito is the chief menace, and as you can't shoot him down when you're asleep you must get behind a protective barrage of mosquito net. Keep it in good repair and use it as ordered. Outside it, don't go about between evening and dawn with bare knees or arms, unless they are well covered with whatever cream, oil or other mosquito flak is issued.

Don't overlook the humble louse, either. His bite carries typhus fever. Keep clean and keep away from natives and their belongings which frequently include a shipload of " passengers."

The third thing which may cause illness is the heat itself. Heat Effects can be countered by keeping strictly to the three basic rules above ; for the stomach is especially susceptible to chills, while constipation and too much drinking make you liable to heat-stroke. Always wear your topi as directed and do not expose yourself unnecessarily to the sun.

A final word. Remember that V.D. is widespread and virulent in many countries abroad. There is no guarantee of any kind that this disease cannot be contracted, except by avoiding all risk of it. The wonderful words " controlled house " or " supervised " mean just nothing from the point of view of Venereal Disease. This fact should be remembered and impressed on all those for whom you are responsible, including yourself.

One last small point about hot climates, not widely known. When you sweat—as extreme heat makes you do—you lose salt as well as water. Therefore make it a rule to increase the amount of salt you take regularly with your meals.

Follow out these rules, hints and tips and you should have no difficulty whatever in keeping fit and doing your job however hot your surroundings. This does not apply, of course, to the Hereafter !

" SOMEBODY SAID THAT IT COULDN'T BE DONE "

Somebody said that it couldn't be done,
But he with a chuckle replied
That " maybe " it couldn't, but he would be one
Who wouldn't say so till he'd tried.
So he buckled right in with the trace of a grin
On his face. If he worried he hid it.
He started to sing as he tackled the thing
That couldn't be done, and he did it.

TEN LITTLE BOMBER BOYS

Ten little Bomber boys off to strafe the Rhine,
One went to Hamburg and then there were nine.
Nine little Bomber boys, one of them was late,
Went and taxy-ed out too fast and then there were eight.
Eight little Bomber boys all their engines revving,
One retracted undercart and then there were seven.
Seven little Bomber boys, one knew all the tricks,
Cut through the balloon barrage and then there were six.
Six little Bomber boys eager to arrive,
One over-boosted and then there were five.
Five little Bomber boys crossed the hostile shore,
One flew level through the flak and then there were four.
Four little Bomber boys, one came down at sea,
Didn't know his dinghy drill and then there were three.
Three little Bomber boys homing on the "Q",
One took QDR for QDM and then there were two.
Two little bomber boys not thinking of the Hun,
Forgot about intruders and then there was one.
One little Bomber boy eager to be done,
Overshot, did not go round and then there was none.
No little Bomber boys left to shoot a line
Of those huge fires left burning at those targets on the Rhine,
And ten expensive aircraft will never fly again
With their ten expensive aircrews who took so long to train.

CORIOLIS

Corrywhatzit ? asks P.O. Prune

Have you tried TEE EMM's Quiz ? Here's question 1. *If you had Coriolis, would you* (a) *strain vegetables through it*, (b) *cook it with a white sauce*, (c) *moisten lips and start afresh*, (d) *paint the bathroom ceiling with it ?*

You don't know? P.O. Prune has just said that if *he* had it, he'd see a doctor right away. Never mind him ! You may now read on !

As an ace navigator you probably take great care over your sextant work. You make your pilot fly dead straight and level when you're taking sights, or put in " George " if there's one fitted ; you check your watch daily by the six o'clock pips before ordering the first half-can of the evening ; you calibrate your sextant for index error and get the dome refraction taped ; if you're tough enough you may even open the cockpit windows and observe through clear air. Yet with all these precautions, the straightest eye in the world and the most perfect flying you would still get an error " creeping in " with most of your results. This is known as Coriolis Error. It doesn't act at the Equator, but is a nuisance everywhere else, being worst at the poles. Here is the why and wherefore.

First of all we are going to imagine that you are flying somewhere north of the Equator, say over Wigan, and are in the act of taking a sight. The aircraft is rock steady, the conditions perfect and everything in the garden is lovely. Now, if you held your sextant exactly upright and could examine the bubble affair closely enough you would see a strange thing. The liquid in the bubble chamber would have surged slightly towards the right-hand side of the aircraft and forced the bubble in the opposite direction. To get the bubble in the centre of the chamber you would now find it necessary to tilt the top of the sextant towards the *left*-hand side of the aircraft. This tilt would only be 4′ or so in these latitudes, but it would always be there, towards the left of the aircraft, no matter what course you were flying at the time or in what direction you pointed the sextant. This, of course, means that the bubble is not indicating the true vertical, the error being the 4′.

Now you don't always take sights with the bubble in the centre of the chamber, in fact, more often than not, the bubble is away from the centre owing to the movement of the aircraft ; but wherever the bubble is when you take your sights, this 4′ error in verticality will occur and affect almost all your results.

Since the accuracy of your sights depends upon the bubble indicating the true vertical, you can see how awkward this error is going to be. In fact, only when " shooting " directly ahead or astern will you get accurate altitudes. This is because in these cases alone is the bubble displaced directly *sideways* to the line of sight and therefore not messing up the vertical angle you are trying to measure.

So much for the error itself. Now for

the causes. There are two of them, one of which we will call Coriolis A and the other Coriolis B. To understand both of them you must imagine that you have been given the nightmarish job of pushing about the world a large ball weighing several tons. We hope your imagination is good.

In Coriolis A you start off with the ball near the Equator. As long as it stays put it is being carried by the Earth's rotation eastwards round the Earth's spinning axis in a gigantic circle whose circumference is about 21,000 miles. Since it goes once round this circle in twenty-four hours its actual speed towards the east is in the neighbourhood of 900 m.p.h. Now, if you started pushing the ball northwards up a meridian, it would, owing to inertia, still try to keep up its 900 m.p.h. towards the east. Unfortunately for you, however, as you go north the ground under your feet has less and less distance to travel in each twenty-four hours owing to the shortening of the radius of spin. Its easterly speed will, therefore, be decreasing steadily below the 900 m.p.h. of the starting point. This means that the ball, while being pushed to the north, will always be trying to move eastwards at a greater speed than the ground over which it is rolling. In other words it will always be trying to move towards the right of its actual path of travel. The faster you try to push the ball the worse the effect will be, because the more rapid will be the decrease in the easterly speed of the ground. So you see that if you want to keep your ball rolling along the meridian, you will also have to spend a lot of energy in stopping it from swerving off to the right.

Suppose now you get bored with travelling north and, after a pause for ale (which the job we've given you certainly calls for), start pushing your ball southwards along the meridian. The ground under you is now travelling gradually faster towards the east, since the radius of spin is increasing. The ball, whch started its new journey with the same easterly speed as the place where you were when you got bored and stopped for beer, will try and maintain that speed as it rolls southwards. If it were allowed to do this the ground would gradually leave it behind and it would get more and more to the west of the meridian. So once again, you see, the ball would tend to swerve to the right of its path of travel, and you would have the same difficulty in keeping it going straight along the meridian as you had before.

Well, that's Coriolis A. For Coriolis B the curtain rises with you and the ball at some point well north of the Equator. The ball is again being carried round the Earth's spinning axis at a considerable speed, though not as fast as it was near the Equator. As long as you leave it alone the ball will stay put in one spot, even though it is being acted upon by two distinct forces ; one, the centrifugal force of the Earth's spin trying to throw it outwards ; two, the force of gravity pulling it inwards. The ball is staying put merely because these two forces exactly counterbalance each other.

Now if you go and start pushing the ball along its parallel of latitude towards the east, you will increase its rate of travel around the Earth's spinning axis. This will naturally increase the centrifugal force acting upon it and the nice counterbalancing will be mucked up.

The ball will tend more than ever to fly straight out into space away from the spinning axis. Gravity, however, will still be strong enough to stop it doing this, so it will do the next best thing and increase its distance from the axis by rolling towards the Equator. The ball is, in fact, again trying to move to the right of its path of travel.

If, on the other hand, you turn round and push the ball to the west, you will, by so doing, be decreasing its rate of travel around the spinning axis. This will in turn decrease the centrifugal force below the counterbalance value and allow gravity to have more than its proper share of the fun. The ball is now being pulled towards the spinning axis harder than the centrifugal force can throw it out, and the result will be that it will try and get nearer to the axis by moving to the north. So, for the fourth time the ball tries to go to the right of its line of travel.

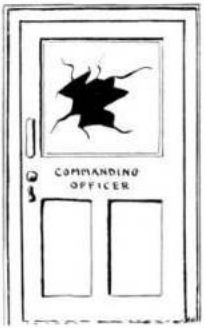
To put the whole business in a nutshell; in the northern hemisphere Coriolis A is the tendency of any mass to move to the right when travelling along a meridian, and Coriolis B the tendency of any mass to move to the right when travelling along a parallel of latitude. (In the southern hemisphere the tendency is always to move to the left. If you've understood all we've told you so far it should be an easy matter to work this out for yourself.) When travelling in any other directions the mass, whatever its height or waist-line, will be affected by a bit of each, the combined result being always a tendency to move sideways to the right. Both Coriolis A and B get greater or smaller according to whether the speed at which the mass is travelling is increasing or decreasing, and they can be proved equal to each other. So whether your mass is being affected by only A or only B or some combination of both the strength of the resultant tendency will be the same.

An aircraft is a mass; therefore, when it is flying along a straight track (in any direction), the Coriolis effect will be trying to make it veer to the right. This tendency to leave the straight and narrow will be offset by the pilot, even though he is quite unaware of the fact. Coriolis, however, will still get through to the bubble liquid, with the result that it will surge to the right of the chamber in its endeavour to veer away in that direction. And that, chaps, is just about where we came in.

One last thought! You remember at the beginning we said that Coriolis didn't act at the Equator and was worst at the poles. We have also mentioned latitude in connection with the actual error caused. So, when you have chewed things over a bit, you may wonder what latitude has to do with Coriolis. Well, it's this way. Both Coriolis A and B have a lot to do with the radius of spin, and the radius of spin depends upon how far you are north or south of the Equator—in other words, your latitude. The important fact to realise is that the nearer the poles you are, the more rapidly will the radius of spin decrease in a given distance. (For instance, between the Equator and latitude 10° N. the radius decreases by only sixty miles, whereas between 50° N. and 60° N. the radius decreases 564 miles.) This in turn means that the decrease in easterly speed of the Earth's surface falls off more rapidly as you get nearer the poles. If, then, you

think about Coriolis A for a moment you will see that it will be much more of an effort to keep the ball travelling straight along the meridian near the poles than near the Equator. In other words, Coriolis A will be worse.

In the case of Coriolis B any increase or decrease of speed around the spin axis is going to make much more difference to the centrifugal force acting on the ball at a short radius of spin than a long. (Try it out with a weight on the end of a



piece of string.) But make sure it's tied on firmly. So, once again, if you think for a moment about B, you will see that the effort to keep the ball rolling straight along a parallel of latitude will be greater near the poles than near the Equator. In other words, B will also be worse.

Coriolis, therefore, depends upon latitude.

Knowing the latitude and the exact strength of the Coriolis effect for a given ground-speed, one can calculate quite easily the amount the bubble liquid in your sextant will surge to the right and how much will be the error in verticality of the bubble. (In these latitudes this will be about 4′ at 200 m.p.h.). All that now remains to be done is to work out what error this will cause in your observed altitudes for different *relative* bearings of the heavenly bodies used. The error will vary from zero for fore-and-aft shots (when the bubble displacement is sideways to the line of sight) to a maximum for beam shots (when the bubble displacement is directly towards or away from the heavenly body). There will now be enough gen to construct a natty little table showing the Coriolis correction to be applied to your observed altitudes against the arguments of ground speed, latitude and relative bearing.

You will find Coriolis correction as part of the acceleration error tables (Z tables) in the Air Almanac. These tables tell you what total correction must be applied to sextant altitudes for bubble displacement due to Coriolis and other accelerations produced by change in course (yaw) and change in air-speed during observations. You are also told there how to use the tables. (By the way, you will find that " air-speed " is used in the Coriolis part of these tables instead of " ground speed." This was done to make things easier, if not quite so accurate, for the person using them. As you can see from our article, Coriolis really depends upon ground speed.)

All that is now left to say is that we hope that what we have tried to put over will have saved you a bit of valuable time by helping you to get your ideas straight.

To carry on to Question 2 of TEE EMM's Quiz. *Coriolis is* (a) *a perennial*

yellow flower of the Compositæ order ; (b) *a famous Greek courtesan of the fourth century,* B.C. ; (c) *a disease affecting the livers of black-faced sheep ;* (d) *a town in Asia Minor ;* (e) *a French mathematician and engineer of the last century who, according to one authority, wrote a book on the mathematical behaviour of a billiard ball ?*

The last is right. Gaspard Coriolis—and what hasn't he started for poor navigators. But at least, when you miss that easy "in-off" you can say deprecatingly "Too much Coriolis !"

"THE PILOT IS BEYOND THE REACH OF A COURT-MARTIAL"

SO runs the comment of A.O.C. Group on the finding of a Court of Inquiry held to determine the cause of an accident to a Hampden. The Hampden was wrecked by crashing into a tree during unauthorised low-flying, and this low-flying was, in point of fact, a show-off dive on a house near the aerodrome. For this wilful breach of discipline resulting in an accident the pilot would probably have been court-martialled. But he wasn't. No court-martial for him : even the A.O.C. had to admit that. For by that crash he had written himself off as finally as if he had put a bullet through his brain, though, of course, considerably less tidily.

Well, that's one way of avoiding courts-martial. Rather a selfish one though ; for it comes very hard on a lot of innocent people. The people, for instance, who sweated to make a highly intricate aircraft, armament, and fittings only to be turned into mere scrap ; the people, many in devastated areas, who saved their shillings to

buy that bomber so that they could give the Hun a little of his own medicine ; the other three people in the aircraft who weren't responsible for breaking the regulations but who were killed just the same ; and, of course, the pilot's young wife, who lived in the house he was beating up and was thus able to see it all beautifully.

That pilot, as the A.O.C. said, is now beyond the reach of a Court-Martial. He is also beyond all possibility of being able to bomb a German town, shoot down a German aircraft, take German lives, or help to reduce German resources in any way. Instead, all on his own, he has destroyed a British aircraft, taken British lives, and wasted British resources. Why ? To show off to his wife, and to prove to himself that Flying Discipline meant nothing to him.

After all, you must admit that flying regulations are not made up for fun, or just to annoy and restrain high-spirited pilots. No, they are instituted to preserve, as far as possible, valuable crews and aircraft when not engaged in fighting the Hun—so that they may be ready and on the spot to fight him when required. Those who pay for the aircraft, make the aircraft, pay for and train the crews could legitimately have a sense of grievance if all this is wantonly wasted by an unfortunate accident. And there are *too many* of these " unfortunate accidents." Not ordinary accidents due to bad luck, bad judgment, bad weather or other causes which can never be entirely eliminated ; but accidents due to sheer carelessness or disobedience.

Read the following from reports of Courts of Inquiry on a dozen recent accidents, all of which occurred within a couple of months or so.

" This accident was due to unauthorised low flying. . . ." " The aircraft was being flown contrary to instructions, below the prescribed height." " . . . not at the time on the duty for which he had been detailed . . . flying low in the vicinity of his home." " . . . exceeding instructions given by his Flight Commander." " The cause of the accident was deliberate disobedience of orders." " . . . carrying out unauthorised low flying." " This is a clear case of unauthorised low aerobatics." " This accident was due to the carrying out of a training exercise in a manner that contravened the order given." " . . . incompetently performing unauthorised aerobatics at an altitude less than that laid down." " The undisciplined action of the pilot is most reprehensible." " There was no justification for the accident for which sole responsibility must rest with the pilot."

Just a sample covering about two months. But the cost to the country of those dozen accidents was thirteen aircraft and twenty lives. . . .

Thirteen aircraft and twenty men fewer to smack at Germany—with not even the smell of a dead Hun to show for it.

" IF you your lips would keep from slips,
Five things observe with care—
To whom you speak, of what you speak,
And how and when and where."

THE SHUFTIOSCOPE

THE Shuftioscope shows what can be done when you have ingenuity plus a determination not to be baffled by circumstances in achieving your object.

In this case the general object was the training of Maryland crews by a squadron in the Middle East temporarily removed from operations for that purpose ; and the particular object was the provision of some sort of synthetic training device like the Epidioscope. The baffling circumstances, however, were that the squadron, now become to all intents and purposes an O.T.U., was nevertheless stationed at a new aerodrome without permanent buildings or electricity—without, in fact, except for concrete runways, any more facilities than an ordinary desert station would have. To get an Epidioscope, which would run from the photographic trailer supply, out from England would, it was discovered, take six months and cost £85.

Deciding that it hardly seemed worth either the time or the money, the squadron then brought its determination and ingenuity into play—and the baffling circumstances had to take the count. And this, for the information of anyone interested or confronted with a similar problem, was how it was done—as described by the unit in a letter to TEE EMM :—

" Some kind of projector was essential for efficient ground training in ship recognition, reconnaissance, Met., etc. and so our C.G.I. decided to build a projector, and the results of this ' knit your own projector ' campaign have been so successful that we feel you would be interested.

" The instrument, now famous locally as the Shuftioscope, was made from pieces of bomb box, six domestic lamps on local purchase, and an 8-inch lens from a U/S F 24 camera. The big snag proved to be that the image projected was too large, but this was overcome in one blinding flash of the obvious by our Gunnery Instructor—being of the film trade in Civvy Street—introducing us to back-projection. This was first tried on a screen of ordinary tracing paper and later using a proper screen of canvas, stretched and varnished.

" From the elementary projection of stills we passed on to overlaps of some of our squadron bombing runs. The idea that if only it was in colour, led to our Gunnery Instructor painting a board to represent a harbour, etc., from about 6,000 feet which we moved across the back of the Shuftioscope to represent a run over a target for reconnaissance purposes. This proved so very lifelike and successful that we went ambitious and decided we would try building an A.M.L. Teacher in the same way. Our mental acrobatics in endeavouring to design one finally resulted in an embarrassed cough and the general opinion that the originator was either a minor genius or had access to a most comprehensive dump from which to scrounge his wheels and pieces.

" However, we took a crack at it from another direction entirely. A strip of canvas was painted in colour, 6 inches

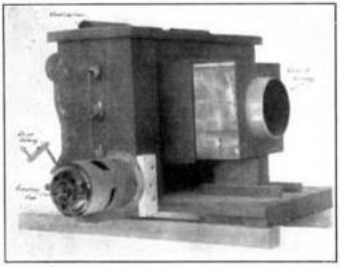
wide and some 60 feet long, representing a complete trip out to a target and return, to a scale of 8 inches to 1 mile, which when projected simulated a cross-country flight of eighty-five miles at a height of 3,000 feet. The trip included practice in simple D.R. navigation, drift and W/V finding, two bombing runs, sea crossing, reconnaissance, map reading, etc. The exercise can be complicated if required by passing any required amount of cloud across the screen, this being done by superimposing a strip of cloud in front of the actual strip.

" Mechanisation then became rather necessary and with the aid of a couple of scrounged motors—also from U/S equipment—and a few gearwheels, plus the body of the same camera, our I.O. produced the necessary feed, and a cooling fan for the lamphouse. This mechanism feeds the strip through the projector quite faultlessly and all that remained to be done was to calibrate it for speed and drift ; then to build up dummy bombsights and draw maps to cover the trip and fit the chartboards. The running speed is even and adjustable to within two to three miles from 90-200 m.p.h.

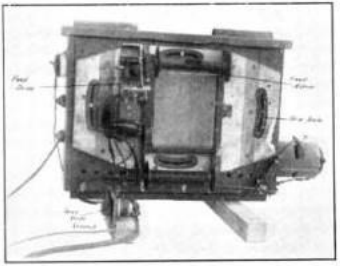
" The exercise has been given to our last two courses and proved most satisfactory. To cut a long story short, and not to bore you too much with tiresome descriptions, we enclose photographs of both the Shuftioscope and the mechanism for the strip."

So that's the Shuftioscope ! The moral of this brief description of its birth is this : Don't be downed by circumstances ! If you haven't got something you want and really can't get it, see if you can't make it yourself or devise something equally as good. In other words, use your ingenuity. Bricks *can* be made without straw.

THE SHUFTIOSCOPE



Showing :—
Top : Ventilation
Left : Drift Setting
" Cooling Fan
Right Lens and Housing



Showing :—
Left : Feed Drive
" Speed Drive Control
Right : Feed Roller
" Drift Scale

THIS MONTH'S ANNIVERSARY—FEBRUARY

IT was not until the end of February, 1918, less than nine months before the war ended, that 2nd Lieut. Donald MacLaren had his first air combat and began his short but meteoric fighting career. He had already spent three weary winter months in France; then one February day, when out with a patrol, enemy aircraft were sighted. MacLaren saw some aircraft almost a mile away at the same height as he was, but whether they were British or German he could not tell; all he had to do for the moment was follow his leader. It was late afternoon, with the sun behind the British; so keeping it behind them as they climbed, they were almost above the Germans before they were seen.

"I was flying next to the leader," MacLaren reported, "and as he dived at one machine I went for another. They were all silver-grey and had double tail-planes. When they saw us coming they tried to get away by descending in large curves." But MacLaren had his man picked out. Down he went and was just about to fire his first rounds in actual fighting, when the enemy banked sharply and came back directly underneath him. MacLaren brought his Camel around almost at the same moment, and dived again. Closing in to less than a hundred yards, he opened fire and could see the tracers from his twin machine-guns streaming into the fuselage of the German aircraft around the pilot's seat. Having passed over the enemy plane he was turning to attack again, when he was overjoyed to see his adversary spinning down out of control. His bullets had found their mark. He saw his foe end in a mass of burning wreckage near the Arras-Douai railway.

MacLaren's first victory was followed quickly by several others, and the unerring accuracy of his fire had, by April, established his reputation as one of the best pilots in a very good squadron.

This month provided one of the most critical periods of the whole war for our airmen, for the British troops were being driven back, and many squadrons found their aerodromes moving to the rear with alarming speed. In addition, they had to cope with the new method of fighting introduced by Richthofen, who patrolled the line with what were then considered huge formations—thirty or more aircraft—in an effort to establish the upper hand in the air. In spite of personal courage and willingness to accept odds, the British pilots could only meet such tactics by flying in similar formations. Thus began a series of massed battles in which ever-increasing numbers were engaged, usually ending in several smaller fights in which the individual still displayed his skill.

MacLaren in a letter at the time, described one of these great "dog-fights" in which twelve of his own squadron in Camels met seventeen enemy scouts east of the Nieppe Forest at a height of 15,000 feet. His words give a vivid picture of what followed:

> "As the Germans saw us above them they began flying in large circles and we began diving at them. We had succeeded in shooting down two when another large formation appeared. We drew out to watch them and

climbed together. At that moment our "Archies" opened fire, the white bursts of shrapnel appearing thickly among the enemy. We were joined by a formation of S.E.5's and some Camels. Then another formation of S.E5's and Bristol fighters drifted along from the south.

"It proposed to be a real air battle—one of the kind you read about but seldom see. We attacked the first formation of Huns, diving at them, firing a few rounds, climbing away and then diving again.

"I swooped down on an Albatross which was painted white with a red nose, and closed with him. He went down in flames and I felt some one shooting at me for all he was worth. From the sound of the bullets I knew he was pretty close, so I climbed away to try and get a look at him. Two of my Camels were chasing a Pfalz who tried to avoid them by turning from side to side. They got him, however, and sent him down spinning.

"There was not time to watch the show, for bullets were flying everywhere. Just then two Albatrosses detached themselves from the mess and picked on a little Camel. I went for them and managed to get close to the leading one, which went down. The other got away by diving under his formation.

"In the meantime the Bristols and the S.E.5's were having the time of their lives. One S.E. which had shot down a Hun was being given a ride by three others, but by a quick climbing turn he managed to get the advantage over one of the trio. The Hun, in trying to avoid him, turned slowly and rammed one of his fellows. Both machines were badly smashed, and went down leaving bits of fabric floating behind them.

"The Bristols had managed to split up the German formation and the enemy, thinking he had had enough, drew off and made for home as fast as he could. Our ammunition had been pretty well used up, so we decided to call it a day. We concluded that at the end of the mix-up there must have been nearly 100 machines taking part."

Not long afterwards MacLaren had an amusing experience with a solitary German. He had flown over alone to attack an observation balloon when he met an enemy two-seater. Diving at the nose of the German machine so that the observer could not swing the rear gun into action he was soon within range. Again, to use his own words:

"When he came within range I pressed the trigger. My gun refused to work. I could hear the trigger rattling away and knew that my firing gear was in good order, so I reloaded quickly. He was past me but I dived underneath and pulled up at him from there.

"Again I fired. Still no shots would come. I pulled off to one side and felt my ammunition chutes—both belts were broken. It was annoying, to say the least.

"The German was not shooting at me for some reason so I sidled up to him to see what was the matter. Still he did not shoot. I went a bit closer and could see the observer standing there with his gun pointing up into the air away from me. Suddenly he waved

to me and I answered. He moved his gun up and down as if to say, 'Mine won't work either.' I came very close, and the pilot waved to me. So I returned his greeting and we parted the best of friends."

From this time on MacLaren bore a charmed life until he broke a leg while wrestling a fortnight before the Armistice. But although his first fight had not taken place until February, 1918, the end of the war found him sixth on the list of successful pilots with no fewer than forty-eight enemy aeroplanes and six balloons to his credit and with the D.S.O., M.C. and Bar, D.F.C., Chevalier of the Legion of Honour and the Croix de Guerre in recognition of his skill, daring and devotion to duty.

THE PARABLE OF THE WISE AND FOOLISH LECTURERS

NOW it came to pass that in those days there were two Lecturers in the land of Raf, at the place called Efts. And the one was wise, but the other was foolish.

And these two Lecturers did each gather unto himself a group of young men seeking much learning. " For," said the young men to the Lecturers, " we *see* that certain Things do such and such, but how indeed they *work* is verily a mystery. Tell us, therefore, all that which is in your minds that we too may be learned in the workings of these Things, even as thou art."

Whereat the two Lecturers said unto them, " Be it even as ye wish ! Draw nigh unto us and we will put forth the gen."

And so they went, each group to each Lecturer in his place.

Now the Foolish Lecturer said in his heart, " Yet again do I have to try to teach these clots. Lo, I am greatly browned off with this job ! But, the sooner it is over

the sooner am I free to depart again unto mine own place." And being thus in a great hurry to be done and not caring whether they learned his wisdom or not, he began his talking even as the young men were still coming into the room.

Thus it was that while he spoke saying, " Verily, verily, I tell thee this and thus " there was yet a mighty clattering of the boots of the multitude so that his words were but half heard. And as he continued there were chairs being drawn out and scraped upon the floor. And even after the young men were all sat down the air was yet filled with coughing. and hawking almost as of a Throat Hospital wherein business is good. And voices arose saying lustily, " What man among ye has my pencil ? " and " Take thy fat elbow out of my stomach ! " and such like phrases common to those who prepare to be instructed. So that there was in the room such noise as never had been heard, not in sky, nor in sea, nor in the uttermost parts of the earth—whereunto it seemed it might easily have reached.

Thus the words of knowledge that were upon the lips of the Foolish Lecturer were as naught, and no man knew that of which he spake. Pictures, yea, and even diagrams he did draw upon the blackboard, but because his words were not heard these did fall upon stony ground, so that the pupils and seekers after learning knew not what he was about and did whisper the one to the other, asking each of each, " What means he ? " and " This seemeth all bull to me."

But even while they were at their whispering the Foolish Lecturer was rubbing from off the blackboard that which he had put upon it and was already straightway discoursing upon that in which he did next seek to engage their understanding ; and thus yet again their ears were shut unto him and they heeded him not, for were they not now about new whisperings, saying "What was that blasted diagram?" And had not one of them, bound beyond measure, drawn an uncharitable likeness of the Lecturer, which he did pass about among his comrades to their great amusement ?

So it came to pass that when the Foolish Lecturer had told them all that which he did know, they were no wiser than when he first started ; nor did any trouble to ask questions, for of these there would have been no end. Yea, even were they less wise than before, for was there not now in their minds much jumble of many words and of pictures which they could not for the very existence of them comprehend ?

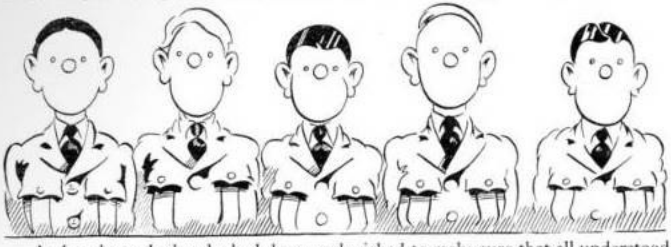
Now, while these things were going on, the Wise Lecturer had gathered together his own group of young men of the same sort, seeking instruction. And he was keen upon his job and did say unto himself, " It is not enough that my wisdom shall leave me : I must make sure that it arriveth in the brains of those whom I am about to instruct. Not only must they hear, but they must likewise understand. Verily is teaching a Co-operative Enterprise."

So as they came unto his room and drew nigh unto him he did wait upon their coming until they had parked themselves each upon his seat, and had finished saying " Wotcher " and " Here we are again " one to the other, and were silent and waiting.

Then he did speak unto them and first tell them shortly that which he was going to speak to them about.

And when he had done that, he did speak about it and tell them.

And when he wished to draw upon the blackboard he did say, " This is how this piece of the Thing appeareth " or " Such-and-such functioneth thus and thus," and the drawings did help rather than hinder their understanding of the spoken word.



And at the end when he had done, and wished to make sure that all understood, he did tell them once more, but again shortly, that which he had spoken about, inviting questions. Nor were there many of these, for all had heard his words, and the few questions did but set the seal upon complete understanding of even the smallest points.

Then did they depart filled with the gen of the Wise Lecturer, remembering and making use of his words, prospering in the place called Efts and throughout the land of Raf. And they did praise him mightily.

But the pupils of the Foolish Lecturer did say " Oh, him ! What a poop ! Verily, he should dedigitate ? "

GUNNERY SENSE

AT great personal inconvenience the Armament Staff of a certain training group, aided and abetted by its many Schools, has produced an excellent Pamphlet on " Air Gunnery." This Pamphlet is well worth reading. All the gen is pukka and we strongly recommend all Gunners and other members of air crews to read it. (We can afford to give it this boost as it in no way enters into competition with us !)

Its official title is

" GUNNERY SENSE "

Air Ministry Pamphlet 132.

Sgt. Stooge wishes he'd read it.

He beat up the Ground Defence.

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