

AVIATION IN CANADA

1917-18



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AVIATION
IN CANADA



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1917-1918

Being a brief account of the work
of the ROYAL AIR FORCE CANADA
the Aviation Department of the
Imperial Munitions Board and
the Canadian Aeroplanes Limited



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PUBLIC ARCHIVES
OF CANADA

*While the contents of this volume
present an accurate history of
the R.A.F. Canada, it is to be
understood that the Air Ministry
is not responsible for any state-
ments made herein.*

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PUBLIC ARCHIVES
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AERIAL CONDITIONS ON THE WESTERN FRONT, 1916.

The battle of the Somme in the latter half of 1916 was the principal factor leading to the formation of the Royal Flying Corps, Canada. Aerial conditions on the Western Front were at this period of so tense a nature that they may well be noted before proceeding to the actual history of the Canadian brigade.

The following sketch makes no pretence of absolute accuracy. The data available at the moment are not official, but are compiled from the memories of several flying officers serving on the Western front at the time. They may, however, be taken as fairly presenting not only the development of the Royal Flying Corps, but also that of opposing enemy aircraft at the period under consideration.

The British Expeditionary Force commenced operations in 1914 with a flying arm of four squadrons or some fifty machines, of which no less than thirty were destroyed during a severe storm at Christmas time by the collapse of a large hangar at St. Omer, leaving on the following day approximately 14 serviceable machines. At this time all aeroplanes in both forces were unarmed.

It is difficult to say whether British or German made the first aerial attack on an opposing machine, but it is undoubted that this type of combat, coming how it may, found both sides unequipped with the exception of such offensive power as might be secured with rifle or revolver. British machines had been thus armed for months, probably in anticipation of forced landings behind the German lines and, without question, enemy aircraft were similarly provided. There ensued a series of sporting encounters out of which grew the necessity of arming aeroplanes with rapid-fire guns

mounted mostly on the top of the centre section so that bullets might clear the propeller blade. This gun was operated by the pilot, who supplied the sole method of forward shooting, while the observer, who was at that time placed in the front seat, fired to the rear. A year and a half afterwards, the method of shooting practically through the propeller was evolved, which, gradually developing, has long since reached mechanical perfection.

In the early summer of 1916, the British strength had grown to some 28 or 30 squadrons in France. These numbered approximately 450 machines, distributed fairly equally along the entire front. A view of our aerial equipment as contrasted with enemy aircraft in the battle of the Somme gives the following data, but it must be understood that this was a period during which every effort was strained on either side and type followed type in rapid succession.

BRITISH.

BE2C 2-seater tractor biplane.
1 or 2 Lewis guns.
Observer in front.
Speed 70 miles.
Climb to 10,000 ft. in 50 mins.
Service ceiling 11,000 feet.

FE2B 2-seater pusher biplane.
2 Lewis guns.
Observer in front.
Speed 75 miles.
Climb to 10,000 feet in 40 mins.
Service ceiling 12,000 feet.

Morane 2-seater tractor
(French) both mono and biplane.
Same guns as BE2C, but with deflectors.
Speed 80 m.p.h.
Climb 10,000 feet in 30 mins.
Service ceiling 15,000 feet.

GERMAN.

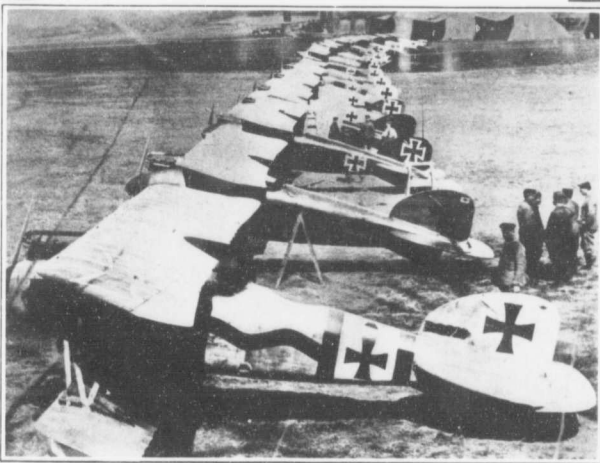
Fokker Scout tractor monoplane.
1 gun shooting through propeller, with deflectors.
Speed 85 m.p.h.
Climb 10,000 feet in 17 mins.

Albatross Scout tractor biplane.
2 gun synchronized in line of flight. (First machine thus equipped.)
Speed 100 m.p.h.
Also 2 seater Albatross machine.

Roland Scout tractor biplane.
armed as Albatross but not quite as fast.
Also Roland 2-seater fighter, speed 90 m.p.h.
Climb 10,000 feet in 20 mins.
Halberstadt Scout tractor biplane, similar to Albatross.



ONE LESS HUN!



RICHTHOFEN'S CIRCUS



GERMAN "ALBATROSS."



GERMAN "HALBERSTADT."

BRITISH—Continued.

DH2 Scout pusher biplane.
1 Lewis Gun on line of flight
or swivelled.
Speed 90 m.p.h.
Climb 10,000 feet in 18 mins.
Service ceiling 16,000 feet.

FE3 Scout pusher biplane.
1 Lewis Gun swivelled in line
of flight.
Speed 100 m.p.h.
Climb 15,000 feet in 19 mins.
Service ceiling 18,000 feet.

Nieuport Scout tractor
(French)
1 Lewis Gun over top of
prop. or swivelled.
Speed 100 m.p.h.
Climb 10,000 feet in 12 mins.
Service ceiling 19,000 feet.

*This was the first allied ma-
chine to have a synchronized
Vickers or Lewis gun in
1916.*

Spad Scout tractor biplane.
1 synchronized Vickers gun
firing in line of flight
through propeller.
Speed 120 m.p.h.
Climb 10,000 feet in 9 mins.
Service ceiling 20,000 feet

In addition the British had a squadron or so of
Sopwith $1\frac{1}{2}$ Strutters, very fast and handy 2-seater
tractors with observer in rear. Also some Bristol
Scouts, Vickers pushers and Martinsydes.

GERMAN—Continued.

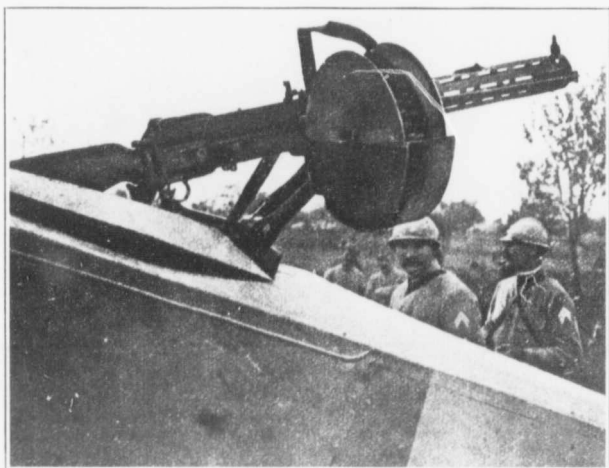
LVG 2-seater tractor.
Albatross and Aviatik, re-
conn. bombing, and photo.
1 gun synchronized and 1
swivelled.
Speed 85 m.p.h.
Climb 10,000 in 25 mins.
Service ceiling 18,000 feet.

The German was in 1916 provided with a gun which did fire through the propeller. This was on the Fokker. The advantage thus held by the enemy was also increased by the fact that their two-seaters carried pilots in front, thus affording the observer a better opportunity of firing to the rear. Our BE2C, for instance, found itself under a handicap in this respect. The downfall of the Fokker rests with the DH2, a pusher machine, which gave the forward-seated pilot a clear field of fire to the front. The DH2, in turn, yielded supremacy to the German Albatross Scout, a fast and efficient fighting machine. Thus went the battle, till in December, 1916, the Nieuport, Spad and Sopwith Scouts were our kings of the air.

In April of this year began a concentration of British aerial force on the Somme, where artillery observation was for the next three months carried to the utmost in preparation for the great offensive staged to commence in July. At first it seemed as though our machines had the air to themselves, for up till the first week in June our registration proceeded with practically no counter-battery work. So quiet was this front, that one pilot reports that he cannot remember seeing more than two German aeroplanes for six weeks.

In June came greater activity on the part of the enemy, but it is without question that we held superiority until September, if at considerable cost. From September, however, to the middle of October, the Royal Flying Corps had its work cut out to cope with the increase in numbers and efficiency of German pilots, and the introduction of two fast and improved fighting scouts, the Halberstadt and Albatross D3 and D5.

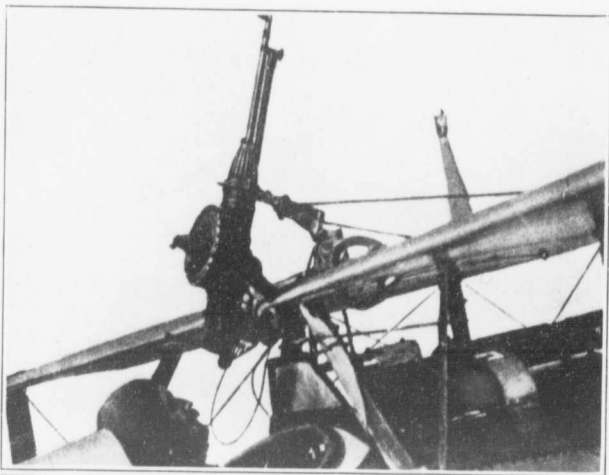
On the Somme front, approximating twenty-five miles, we had about twenty squadrons, equalling about 300 machines; these constituting the majority of our aerial force in France. Twelve were disposed for artillery work, the remainder for photography, reconnaissance and fighting.



GERMAN PARABELLUM MOUNTING.



FIRST "FOKKER" MONOPLANE WITH SYNCHRONIZED GUN
BROUGHT DOWN ON WESTERN FRONT.



LOADING POSITION.



LEWIS GUN ON NIEUPORT SCOUT.

The battle proceeded with unprecedented intensity, and with it a never-ending aerial warfare. Pilots were rushed from England with a few hours' solo work and absolutely no gunnery practice, to find themselves instantly in the thick of the combat. It is, therefore, not astonishing that the wastage of our fighting men ran up to twenty-five per cent. per month.

The filling up of the Royal Flying Corps combatant strength was made additionally difficult, as the Corps could no longer draw from regimental officers now needed for the coming offensive by which it was proposed to relieve the tremendous pressure on the French at Verdun.

It is true that the strength of the Force was, in anticipation, more than doubled during the three weeks which preceded the Somme, but this largely exhausted the available supplies of fighting personnel.

How reasonable, therefore, that the established success of Canadian pilots, and the fact that in Canada lay an almost untapped reservoir of future strength, should turn the eyes of the War Office to that Dominion. Double operations were planned for the Spring of 1917. The need was instant and imperative.

OFFICIAL PRELIMINARIES.

Authority for the Royal Flying Corps, Canada, was given at the War Office in December of 1916, and shortly after, on December 21st, an important meeting took place at Adastral House, the headquarters of the Air Board. Representatives from various branches of the service were present, and the situation in Canada was fully discussed with the following results.

Formation of squadrons was to be pushed at once, and personnel sent out as opportunity offered. Recruiting offices were authorized, also one large aircraft park, its location to be fixed later. As to equipment, Curtiss machines had already been ordered and delivery would commence almost at once from Buffalo. An establishment of 400 engines with a monthly wastage of 100 was considered reasonable.

The use of other machines was discussed but left in abeyance for the meantime, and the meeting closed with the opinion that training could be carried on in Canada the year round except in February, the weather in that month being doubtful.

It was decided at the outset that everything of a business nature, such as the erection of buildings, preparation of aerodromes, purchase of supplies, etc., was to be handled by the Imperial Munitions Board, through a Department of Aviation. This conclusion was largely influenced by the fact that in correspondence with the Ministry of Munitions, the Imperial Munitions Board had placed itself at the disposal of the War Office to aid in the formation of a Canadian training wing. Two engineer officers would be detailed to act as advisers on buildings and aerodromes.

Such was the formal birth of the Royal Flying Corps, Canada. It may be asked why it was purposed to recruit and train in Canada by the agency of an

Imperial wing, but it suffices to say that the work of this unit has been only one of the countless instances of coöperation between the mother country and the Dominion, that furthermore all arrangements entered into carried not only the consent and approval of the Canadian Government, but also the promise of every assistance, and that the utter fullness of the discharge of this promise is known best to those who are personally conversant with the various phases of the history of this unit of the Royal Flying Corps.

At the further meeting of the Air Board, held at Adastral House, January 1st, 1917, the personnel of the advance party was selected. The administration section consisted of the Officer Commanding, at that time lieutenant-colonel; two squadron commanders—a major and a captain; one flight commander—a captain; one flying officer—a lieutenant. The supply section consisted of one park commander, one first-class equipment officer and two second-class equipment officers; these a major, captain and two lieutenants. Two engineer officers, both majors—one of whom was of the Canadian Engineers and the other from the Royal Engineers services—followed a little later. The recruiting section, composed of a captain and three lieutenants, completed the party. Mechanical transport of 21 vehicles was also sent.

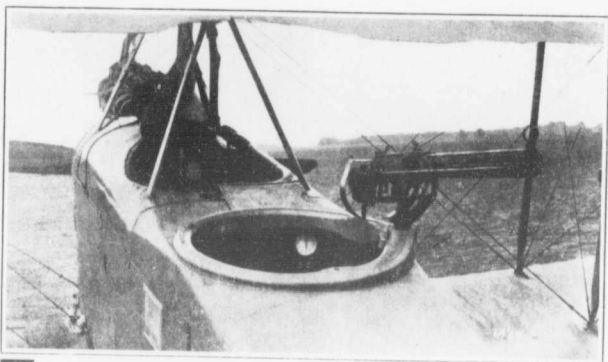
At this meeting the general premises governing the future operations of the wing were outlined, such as the intention to give only lower training in Canada, and liaison between the unit and the Imperial Munitions Board. It was further determined to organize twenty training squadrons. Owing to conditions in England at the moment, the question of personnel for the formation of the Canadian wing was difficult of solution, and it was stated quite frankly that the Royal Flying Corps, Canada, would be obliged to do its utmost to train both officers, non-commissioned officers and airmen for the various duties to be performed.

General and personnel equipment was arranged to be sent from England, but all machines and additional transport were to be obtained locally. The general purport of the meeting was, in brief, to provide the skeleton of a training unit, put this scanty personnel under the direction of the O.C. and trust to their united efforts to provide for that expanding output of partially trained pilots for which at the time there was such insistent demand.

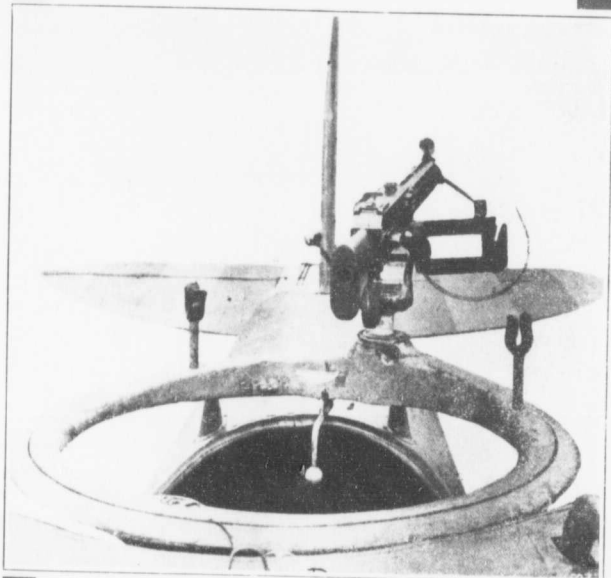
Coincident with all this, matters in Canada had already begun to take shape. There was in Toronto a small aeroplane factory, which for the past year or two had been turning out machines used at a private flying school some nine miles from the city. Authority was received by the Imperial Munitions Board from the Air Board to acquire this organization, which, although its output was necessarily limited, afforded an opportunity for future expansion, once suitable premises were secured. The machinery and equipment of this undertaking were forthwith moved into much larger buildings leased from a local engineering works, and took shape as the Canadian Aeroplanes Limited, an organization owned by the Imperial Government, whose product was intended primarily to meet the requirements of the new Canadian wing.

Simultaneously there was formed the Aviation Section of the Imperial Munitions Board, to which section detailed reference is made elsewhere. Such, in short, were the arrangements which had been completed when on January 22nd the advance party of the Royal Flying Corps, Canada, arrived in Toronto.

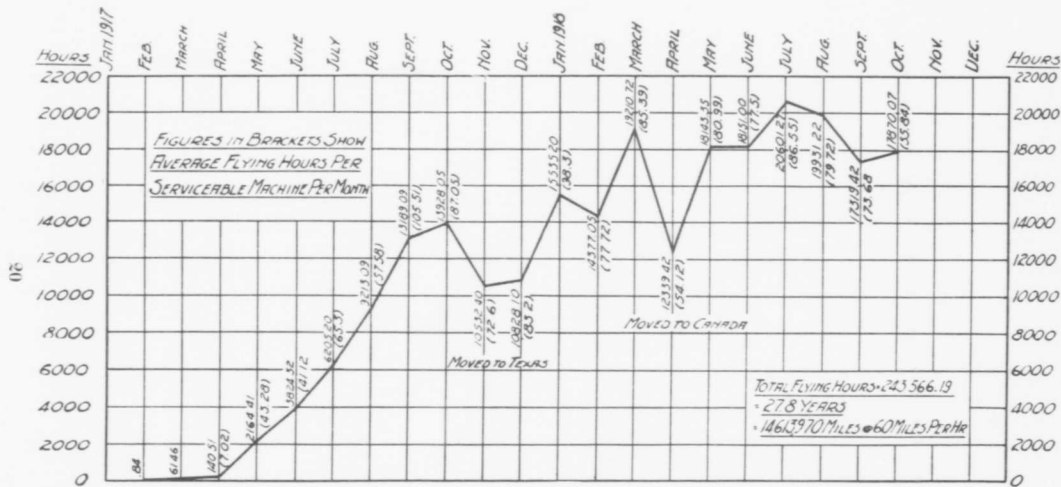
A word about local conditions will not be amiss. The country was, of course, deep in snow, and the winter period in its most trying phase. Recruiting, for which methods had still to be formulated, was complicated by the fact that no Military Service Act was in force in Canada, and the country had been



OBSERVERS' GUN MOUNTING



GERMAN GUN MOUNTINGS.



RA.F. CAN. - FLYING DUTY OF MACHINES.

apparently combed bare of those who desired to enlist voluntarily. It is true that the Royal Naval Air Service had for months been drawing excellent material from Canada, but this unit offered the inducement of a commission on enlistment, while the R.F.C. held no commissions in its outstretched hands, but merely the promise of months of arduous work before qualifying for the distinction. That the Corps was authorized to recruit in Canada was due to an Order in Council passed by the Canadian Government. Application was also made to the Department of Militia and Defence that the unit might be rationed, clothed and medically attended to by that Department.

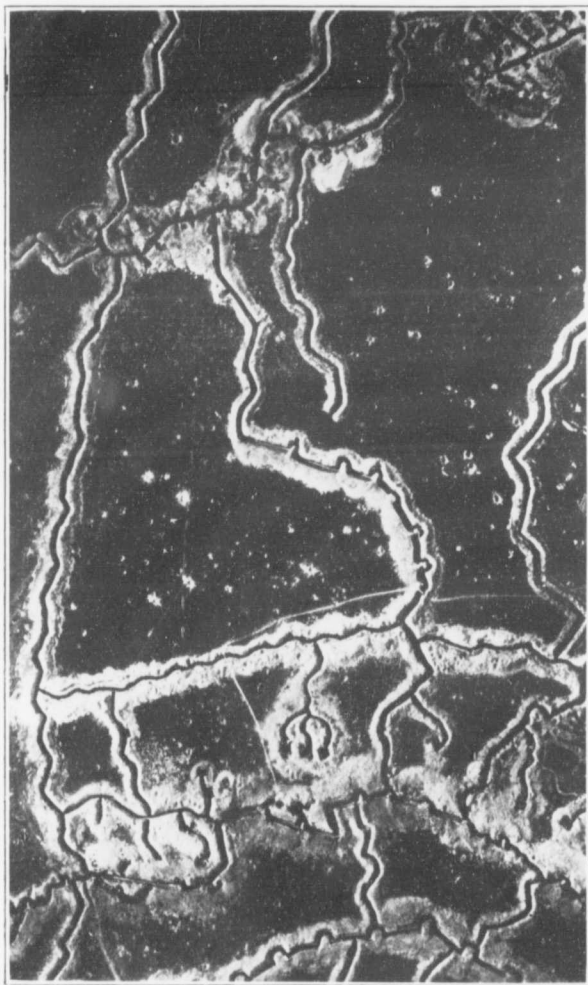
An excerpt taken from an early report on Canadian conditions to the Air Board notes that the Royal Flying Corps, Canada, was an Imperial unit, paid for by the Imperial Treasury and wholly independent of local military command. Also that instructions in the first instance were very indefinite regarding a host of important details, but that this fact was in the long run a blessing in disguise.

A credit of four millions sterling had been established with the Imperial Munitions Board for the purposes of the wing, and it now remained to take action as quickly as possible.

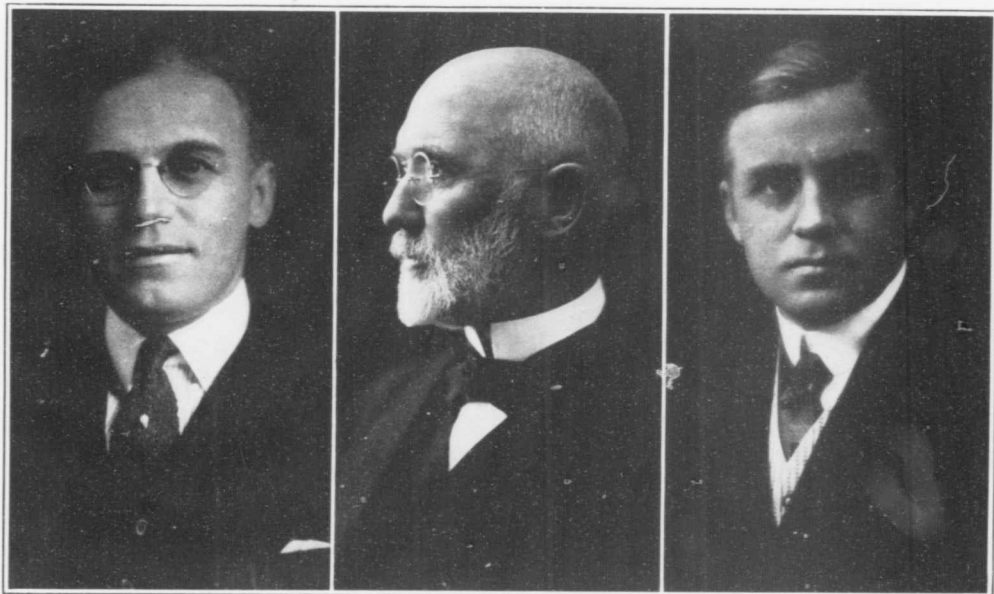
That no time was lost may be gathered from the fact that the large C.E.F. Camp at Borden, some seventy miles north of Toronto, was inspected on January 26th, and on the following day a contract was let under supervision of the Aviation Department of the Board for the construction of the first Canadian aerodrome on an outlying portion of this area. It was to comprise fifteen flight sheds, with all necessary buildings and equipment. Simultaneously, recruiting got under way. Ground was also provided by the Department of Militia and Defence at Long Branch, some nine miles west of Toronto, where was formed the first flying unit of the Royal Flying Corps, Canada.

During the last week of the month, a contract was let for the construction of a large factory for the Canadian Aeroplanes Limited, supplies of engines and machines were secured from the Curtiss Manufacturing Company at Buffalo, and sites for additional groups of squadrons were selected at Leaside, three miles north of Toronto; Armour Heights, four miles still farther north; Rathbun and Mohawk, 130 miles east of Toronto.

Such was the record for nine days' work. Thus the first of February found the unit with all major features of its programme settled, and on the threshold of a development which, as it progressed, was destined to realize every anticipation.



TRENCH SYSTEM ON WESTERN FRONT.



G. A. MORROW, ESQ., O.B.E.
DIRECTOR OF AVIATION,
IMPERIAL MUNITIONS BOARD.

SIR JOSEPH FLAVELLE, BART.,
CHAIRMAN,
IMPERIAL MUNITIONS BOARD.

SIR FRANK BAILLIE, K.B.E.,
PRESIDENT,
CANADIAN AEROPLANES LIMITED.

AVIATION DEPARTMENT---IMPERIAL MUNITIONS BOARD

This Department formed a many-sided organization, by means of which the physical and financial wants of the Royal Air Force, Can., were provided. It secured funds from the War Office, spent and accounted for them; designed, built, and equipped innumerable structures; purchased all supplies from the sailmaker's needle to the aeroplane and bought materials from countless sources for a vast variety of needs.

It delved into electrical and mechanical problems, sowed grass, bored wells, built railways, leased land, secured labour of all descriptions, engaged lawyers and advanced money. If the Royal Air Force was an Imperial brigade, this section of the "I.M.B." was no less a Canadian civilian battalion, composed of members representing an officer commanding, paymasters, quartermasters, engineers and sappers, etc., and maintaining a constant and helpful liaison, without which a certain history of mutual accomplishments would be the acme of brevity.

The Department, for purposes of efficiency, was subdivided into the following sections: Executive, Purchasing, Construction, Transport, and Aeronautical Supply—all responsible to the Director of Aviation, and through him to the Imperial Munitions Board proper. The officers were:

Director of Aviation . . G. A. MORROW, ESQ., O.B.E.
Secretary MR. GEO. E. WISHART.
Chief Engineer MR. J. B. CARSWELL.
Asst. Chief Engineer . . MR. J. R. HAGELIN.
Purchasing Agent . . . MR. A. H. MULCAHEY.
Asst. Purchasing Agent MR. A. S. MCNINCH.
Supt. Aero. Supplies . . MR. W. B. CLELAND.

The first section, composed of the Secretary and accountants, was responsible for all expenditures, and made weekly detailed returns to the Auditor of the

Board in Ottawa. They dealt in millions, and submitted vouchers for all disbursements, as well as reporting all executive transactions. The advantage of this co-operation with the parent organization which dealt in hundreds of millions, is obvious.

The Purchasing Section was manned by expert buyers in various branches, and furnished the entire needs of the brigade with the exception of rations, pay and medical service. Machinery, tools, boots, oil—there were some ten thousand articles in Stores Depot—all of which were secured by this section of the Department.

The Construction Section, since the autumn of 1917, erected all buildings used by the brigade, and overhauled and remodelled other premises secured for their use. At the outset of operations, various contractors were employed—but, this practice terminated, the Construction Section was organized under careful supervision of competent engineers of the Aviation Department to perform these and added duties. It purchased its own supplies and was responsible for prices and quantities, as well as for a Commissary Department which supplied employees with meals and accommodation.

Transportation—always a problem and especially so in wartime—was entrusted to an expert railwayman, skilled in harassing railway companies into good delivery. The moving of thousands of men to and from Texas, with hundreds of carloads of supplies, came under this section with most creditable results.

Aeronautical supplies were in charge of an expert in aeroplanes and their parts, who stood between the aeroplane factory and the aircraft equipment section of the brigade. Through him were followed up all machines, engines and spares ordered by the Purchasing Section. Contact was maintained hereby with American factories, to which periodical visits were made when the brigade was dependent on these extraneous sources of supply.



J. R. HAGELIN,
ASST. CHIEF ENGINEER



J. B. CARSWELL, B.Sc.,
CHIEF ENGINEER.



GEO. E. WISHART,
SECRETARY.



G. A. MORROW, O.B.E.
DIRECTOR OF AVIATION



W. B. CLELAND,
SUPT. AERONAUTICAL
SUPPLIES.

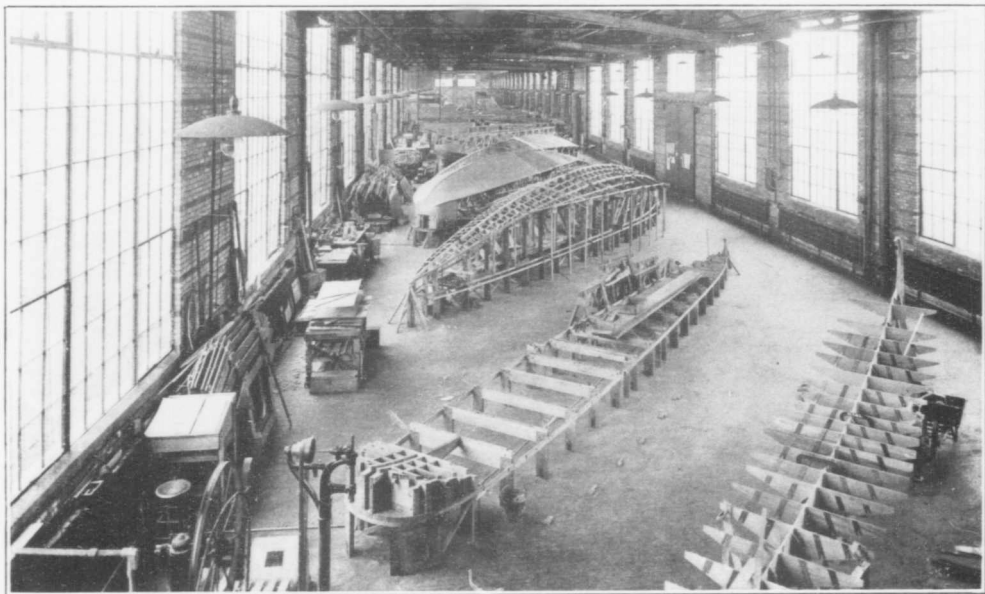


A. N. MULCAHEY,
PURCHASING AGENT



A. S. MCNINCH,
ASST. PURCHASING AGENT

OFFICERS, AVIATION DEPARTMENT, IMPERIAL MUNITIONS BOARD



FLYING BOAT HULL CONSTRUCTION—CANADIAN AEROPLANES LIMITED.

Such in brief are the fundamentals, but without further detail the service given by the Aviation Department could not be realized. The following notes therefore, should prove of interest.

Accounts were under the immediate direction of the Secretary. So speedily was the Department organized that time did not afford to investigate either the system to be adopted or the number of accounts to be opened. Flexibility was in consequence desirable, and when in October, 1918, a new set of ledger headings were called for by the Air Ministry, there was neither difficulty nor delay in remodelling the existing accounts to the new form.

The Department was authorized to make disbursements from an imprest fund when immediate payment was necessary, but this method was only used when unavoidable, as for instance, outlay in staff payrolls, initial payments for leases, and in cases where a discount period had nearly lapsed. For such outlay repayment cheque to the fund was always subsequently issued.

The standard method of meeting obligations was by sending certified bills to the Finance Department, Imperial Munitions Board, at Ottawa, where cheques were issued therefor. These bills were listed in alphabetical order, and also chronologically under each creditor's name. Confusion of any kind was entirely avoided.

During those months when contractors were employed in the erection of buildings and other work, the Aviation Department was continually represented at the contractor's office by an auditing staff. These officials checked all time worked, and all disbursements of every nature on the part of the contractor. Such obligations were paid by the latter, who then forwarded

the receipted bills to the Department. There they were recorded and sent on to Ottawa for payment.

Extraneous accounting was done in the United States. When a large part of the brigade went to Texas in November, 1917, the omnipresent "I.M.B." accompanied in the person of the Chief Purchasing Agent, fortified with an imprest fund. This, deposited in the National City Bank, permitted local payments, which in turn were submitted to the Toronto Office with the necessary vouchers. In addition to all the foregoing, the Board at Ottawa was represented by a travelling auditor who checked all expenditure before it was submitted to Ottawa. Thus the Chief Auditor was kept constantly informed, and enabled to make regular reports to the Ministry of Munitions in England of all disbursements by the Aviation Department.

On page 58 will be found a monthly total of these amounts, as apart from expenditure by the brigade. It is impossible to make comparisons, but it is nevertheless believed that in no section of any military organization has better value been secured for the amount involved.

The Purchasing Section, up to January 1st, 1919, issued 15,700 orders and handled 37,300 invoices. Business of this magnitude demands system, and in this case got it. On page 35 is a diagram showing not only the procedure of purchase, but also the history of invoices when received, reflecting the coöperation between consumer and purchaser to secure assurance of the delivery of what has been ordered, before payment.

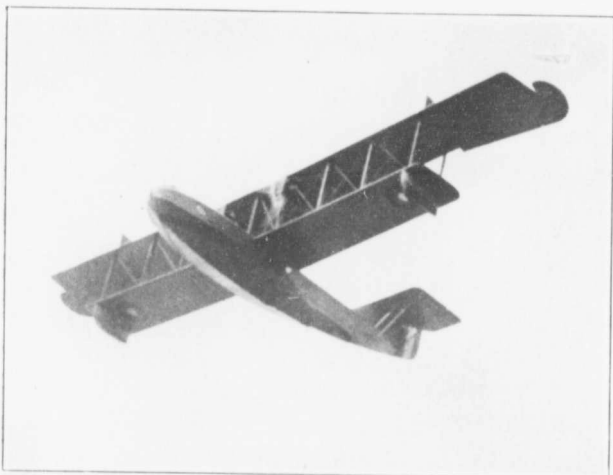
Mention has been made of the variety of the purchases arranged by this section, and to this might be added the fact that extremely large quantities were involved.



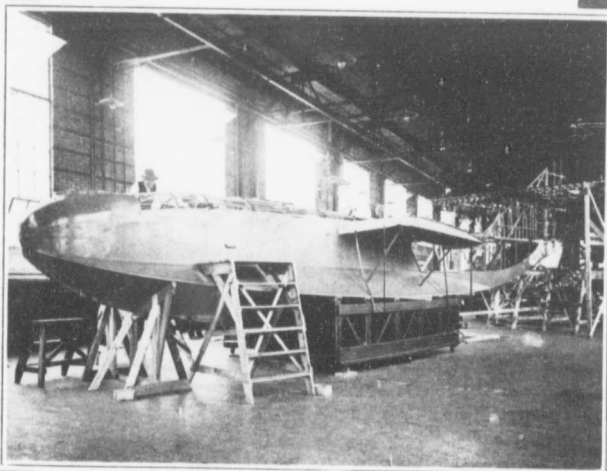
BARRACK BLOCKS—CAMP MOHAWK.



TAPPING A SPRUCE FOR AEROPLANE TIMBER.
(Note axe swinging from belt).



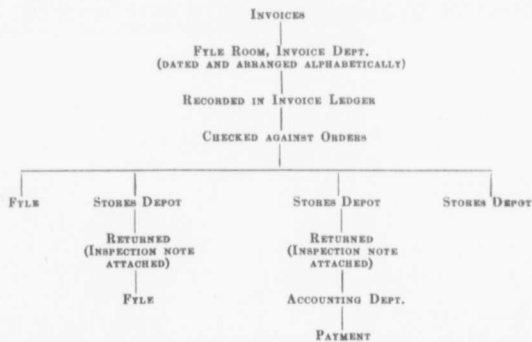
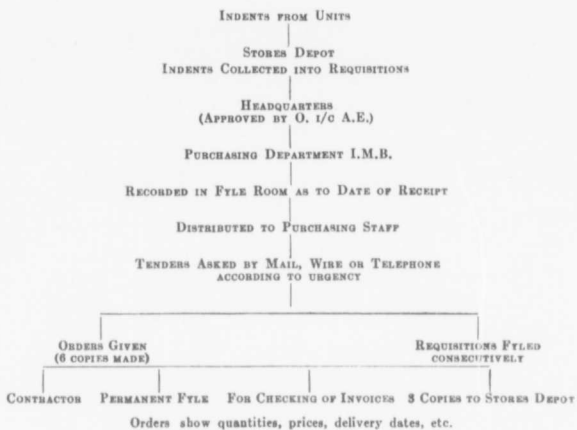
IN FLIGHT.



FLYING BOAT HULL UNDER CONSTRUCTION.



GETTING IT OUT.



Fuel requirements for the current year, for instance, were estimated at nearly 30,000 tons, and, in spite of certain official privileges extended to the Department, shipments of this magnitude called for very special attention, particularly at a time when great public anxiety was felt in securing fuel supply.

Gasoline requirements comprised about 16,000 gallons per month, and this, owing to the limited storage capacity at the various wings, was very carefully watched and traced in transit. It speaks well for the Department that during a period when the railway system was congested with freight, flying was not at any time interfered with owing to shortage of this supply.

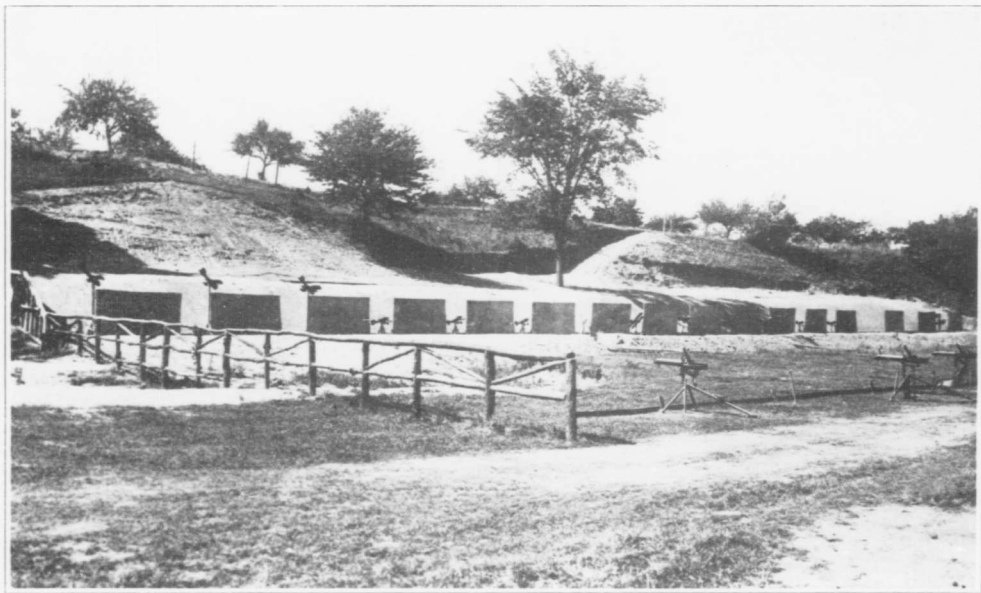
The Transportation Section was indebted to the wonderful coöperation of contractors and railway companies for assistance in overcoming delays due to this congestion, as well as to the great shortage of raw material.

Business between the Curtiss Aeroplane and Motor Corporation and the British Ministry of Munitions was carried in the Section's purchasing ledgers, as well as records of all shipments from the Canadian Aeroplanes Limited to the Signal Service of the U.S. Government. The amount of material shipped to Texas in 1917 from the factory amounted to not less than four and a half million dollars. This was a mutually acceptable arrangement by which training in the U.S. was carried out most successfully and the output of the factory maintained at a satisfactory point.

Conjointly with the Purchasing Section, there must be considered its kindred bureau, the Traffic Branch. This body traced and delivered all materials to their proper destination, checked all freight and express bills, and applied them against their proper invoices and orders. Investigation of conditions governing freight rates was a special study, and in one instance the Traffic Branch was able to prove to the Canadian Freight Association that the minimum carload weight previously required on shipments of aeroplanes and spares was in point of fact unjustified considering the light nature of the material. This was subsequently increased, resulting in a marked saving in the transportation of such material to and



CONSTRUCTION OF SWIMMING POOL, CAMP BORDEN.
(Under Direction of Aviation Department.)



RANGES CONSTRUCTED BY AVIATION DEPARTMENT AT BEAMSVILLE. ✓

from the various camps. The Texas movement involved 375 cars and 5,000 men. This was an admirably managed undertaking, so successful that within five days from the date of leaving Canada our machines were climbing into the air above Texas aerodromes.

The Section of Aeronautical Supply, as has been stated, maintained liaison between the Aircraft Equipment Branch of the brigade and the factory; also it acted as a buffer state between the brigade and the manufacturer of such technical equipment as cameras, wireless instruments, machine guns, etc., and the tremendous number of spare parts involved.

The progress in the training of pilots has from time to time demanded new equipment of multitudinous variety. The advanced nature of the work of both aeroplane and engine repair park called for a steady stream of those individual members which when assembled constitute the completed machine. The selection, purchase, and delivery of the technical equipment of the brigade, fell in short to this section, which executed the business transactions involved as required by the Aircraft Equipment Branch at headquarters.

Liaison between the two has been admirable, and the result, therefore, eminently satisfactory.

The Construction Section has, in the course of its strenuous existence, carried out the following work:

- 6½ miles of railways.
- 22½ miles of roadways.
- 18 miles of water mains.
- 10 miles of sewers.
- 27 miles of aerodrome drainage.
- 300 miles of telephone and power lines.
- 26 individual steam heating plants.
- 6 central steam heating plants.
- 400 buildings using 18 million feet of lumber.

It had, furthermore, put in five thousand plumbing fixtures; cleaned, rolled and seeded nearly four thousand acres of land for flying purposes, and done a commissary business which touched forty thousand meals a week.

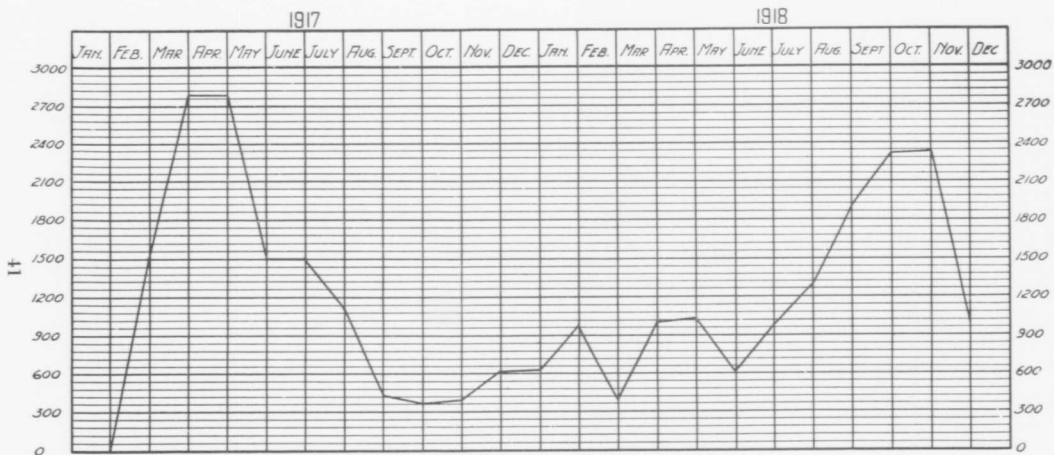
In these activities it spent five and a half million dollars.

From all of which it may be seen that what was accomplished equals the building of a modern town with streets, sanitation of every description and every physical equipment.

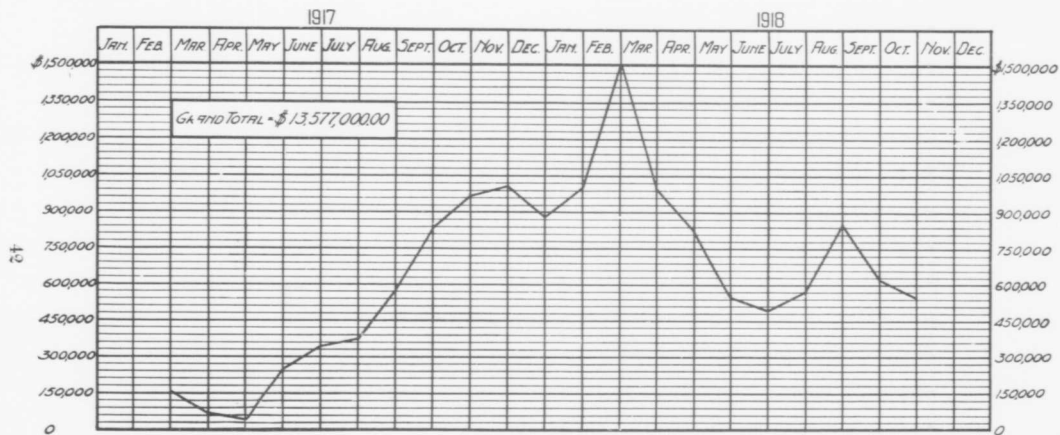
Had it been a town the work had been easier, but as it was there were many areas, with two hundred miles between extreme points.

In dispensing with contractors and assuming itself all obligations the Department was swayed by but one fact. The requirements of the brigade were so varying and so subject to training considerations, that it seemed impossible to adequately provide for all contingencies by contract. The change took place in the autumn of 1917, and in the months that followed the Munitions Board profited by unity of control, by the opportunity of large bulk purchases of material, and by every consequent advantage accruing to a single organization which directs many scattered operations.

The Chief Engineer of this section directed executive work, his assistant supervised construction. With them were the heads of the draughting room, the estimating section and the construction purchasing department, together with the chief electrician, the plumbing superintendent, the heating superintendent, road superintendent and the head of the commissary and transport section. In the section office a staff of fifty was employed, when in the middle of October, 1918, there

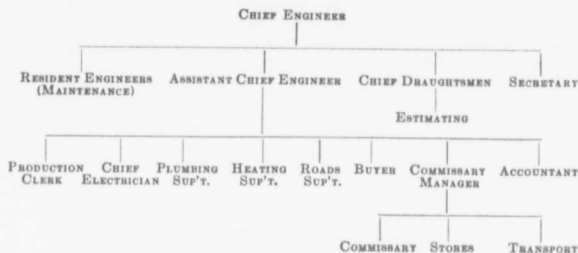


R.A.F. CAN. EMPLOYEES ON CONSTRUCTION WORK SUPERINTENDED BY I.M.B.



CANADIAN AEROPLANES LIMITED - MONTHLY VALUE OF OUTPUT

were 2,200 men on the payroll. The following diagram illustrates the organization:—



The Construction Section was, in fact, pivoted so that it might at any moment turn its attention to new work without departing from its main and central programme, and to this flexibility is attributable the unquestionable success it achieved.

CANADIAN AEROPLANES LIMITED.

This organization saw the light officially in December, 1916, and in twenty-one months had turned out some 2,900 aeroplanes, valued at nearly fourteen million dollars. Incidentally, the factory covered about six acres, and employed something over two thousand hands.

It was some time before Canadians realized that the undertaking was that of the Imperial Government acting through the Imperial Munitions Board, more familiarly known as the "I.M.B." The primary purpose was that of supplying aeroplanes for the Royal Flying Corps, but actually some four and a half millions' worth of output went to aid training in the United States.

The officials of the Company were:—

President.....	SIR FRANK BAILLIE, K.B.E.
Vice-President.....	MR. FRANK P. WOOD.
Director.....	MR. W. PARKYN MURRAY.
Manager.....	MR. E. T. MUSSON.
Secretary.....	MR. P. H. BROOKS.
Chief Engineer.....	MR. M. R. RIDDELL.

Work commenced in leased premises, where the plant of a small factory which had a year or so before turned out a few experimental machines was for three months utilized. This, admittedly a makeshift, expanded in April into permanent premises on Dufferin Street, covering ultimately some six acres of floor space, with innumerable mechanical appliances specially designed for the work. The building of this factory proved something of an achievement, being completed in about two and one-half months, a notable record even in a country where quick construction was the rule of the day. The site, carefully chosen, lay surrounded by the homes of large numbers of technical trades-



G. A. COOPER
CHIEF INSPECTOR.



H. R. BRISTOW
ASST. SUPT. FINAL ASSEMBLY
AND PANEL DEPTS.



C. E. PEARSON
SUPT. WOOD MILL.



W. E. TRENZA
MASTER MECHANIC



L. W. COLLIER
SUPT. METAL DEPARTMENT



E. ASHWORTH
SUPT. FINAL ASSEMBLY
AND PANEL DEPTS.



G. N. DUFFY
GENERAL SUPT.



P. H. BROOKS
SECRETARY.



E. T. MUSSON
MANAGER



SIR F. W. BAILLIE, K.B.E.
PRESIDENT.



W. P. MURRAY
DIRECTOR.



M. R. RIDDELL
CHIEF ENGINEER.



G. A. AULT
DESPATCH DEPARTMENT.



D. J. NEWSON
CHIEF DRAUGHTSMAN.



H. R. CHOATE
ASST. SUPT. METAL DEPT.



G. R. C. MERRIAM
CHIEF ACCOUNTANT



W. B. MACDONALD
PLANT ENGINEER.



J. M. WATERMAN
ASST. CHIEF ENGINEER



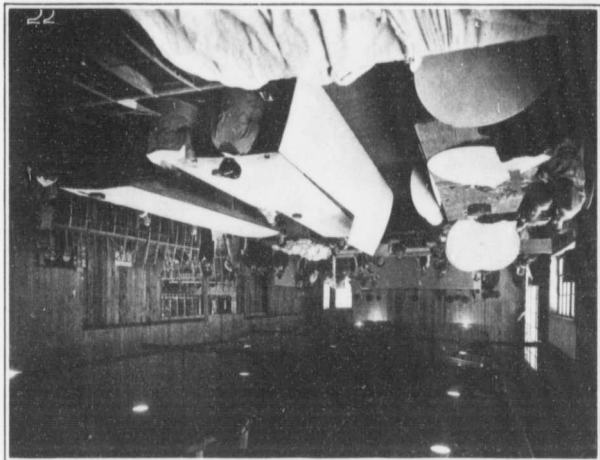
A. H. SALTER
ASST. SUPT. WOOD MILL



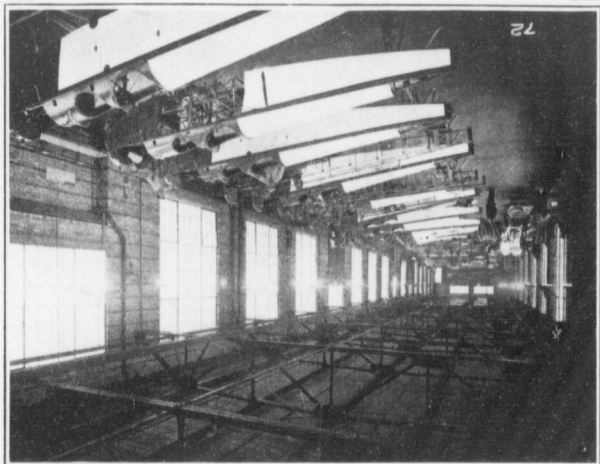
F. L. SHILLINGTON
ASSISTANT SECRETARY.

OFFICIALS AND EXECUTIVE STAFF OF CANADIAN AEROPLANES LIMITED

WING ASSEMBLY



FUSELAGE ASSEMBLY



men, and this helped in no small degree to ensure at all times a full force of highly skilled employees.

The machine adopted for use by the Royal Flying Corps was the Canadian JN4, of simple design and presenting no unusual difficulty in manufacture. As work progressed, however, it became apparent that the type could be largely improved by change of design and fabrication, and there was evolved a machine which, while presenting the same appearance as its predecessor, contained nevertheless certain fundamental and radical alterations. Among other points remodelled were the landing gear—the substitution of the “joy stick” for the former control wheel, the adoption of split trailing edge instead of flattened tubing, and, most important, tail units made principally of metal instead of wood, resulting in an increased factor of safety, especially in the rudder and vertical stabilizer. Progress without change is impossible, and thus it proved in this undertaking.

It will be understood that given soundness of design there remains to be provided good workmanship and the best and most suitable materials. The former was procured without much difficulty, but the supply of the latter involved much thought and experiment, it being always remembered that the ideal machine combines a maximum strength with a minimum weight.

Linen for the covering of wings, etc., was imported first from Ireland, but submarine activity made it imperative that a substitute be secured. It was found at the Wabasso Cotton Company's mills in Three Rivers, Quebec. Here was secured, for the special purpose required, a cotton fabric of remarkable strength. One inch in width is able to support some eighty pounds, and this with a weight which does not exceed four and a half ounces a square yard. Its adoption was at once successful, and it proved capable, when treated with “dope”—a waterproof and windproof solution with celluloid-like finish—of performing the same service as that of the most expensive Irish linen.

After fabric came wood, the quality of which was required to be above anything hitherto known in the lumber trade. Free from knots, of extreme length, with no "wind shakes," swirly grain or "pitch pockets," it seemed at first unprocurable. Ash for the longerons or longitudinals of the fuselage, and spruce for wing beams, wing edges, etc., was of imperative necessity. The market was searched, but what material was available proved to yield but a fraction of its total in satisfactory timber. Then, driven by urgent need, the "I.M.B." organized a department in Vancouver and began to buy for itself on the shores of the Pacific. That its first purchase was rushed by express in carloads from the Western Coast will indicate how extreme was the pressure for sound material. The illustrations on pages 32 and 34 give some idea of the magnitude of the operations required to produce that exact quality of lumber which the modern aeroplane demands.

It is interesting to note that even with this admirable supply secured, it was found that certain members were so long that it proved necessary to build them up, and, in the building, the Canadian Aeroplanes Limited evolved a scarfed, saw-toothed splice, since adopted as standard by Britain and the United States. Repeated tests proved that greater strength was thus secured than that of solid lumber of the same dimensions.

The Canadian Aeroplanes Limited propeller is five-ply white oak, glued, compressed and formed up by machinery that is almost human—and took its origin from a lathe designed by Peter the Great to make gun stocks. It is a far cry from Russia to Toronto, but the principle is identical. No "C.A.L." propeller has shown manufacturing or engineering defect. The successor of Peter's lathe carves them, four at a time, to one thirty-second of their finished form, and the final touches and balancing are hand work. To anyone who has seen a nine-foot propeller running at 1,500 revolutions per minute, its blade

points cutting the air at the rate of eight miles a minute, it will be apparent how fine a workmanship and accurate a design is embodied here.

From wood pass to metal. Fuselage and internal wing bracing is with piano-wire which will stand a pull of a ton, though the members to which it is anchored weigh but a few pounds. Interplane bracing will live up to a ton and a half, and the control wires will stand the same test. So accurate are these latter that in process of their manufacture the heated metal is drawn through a forming die made of an aperture in a diamond.

In the autumn of 1918 it was decided to undertake the manufacture of a faster and more modern type of machine—the Avro—and to this object the factory diverted its energies. At the date of the armistice two had been turned out. These machines, equipped with 130 horse-power Clerget engines, promised excellent service, and underwent all tests to the complete satisfaction of all concerned. No less than one hundred additional had been fabricated and were ready for assembly when hostilities ceased.

Design — material — workmanship — inspection! These are the four cardinal features of the modern machine. That all have been amply provided in the output of the Canadian Aeroplanes Limited is best evidenced by the fact that not a single one of nearly three thousand aeroplanes turned out has been charged with any accident attributable to any fault in design or manufacture.

From aeroplane to flying boat was a natural transition in an organization so finely balanced and completely equipped, and in April, 1918, the Canadian Aeroplanes Limited undertook to build for the United States navy a fleet of 30 F-5 flying boats, the largest produced to date on this side of the Atlantic. The contract involved competition with two other companies. The latter had been in the business from

two to four years, and had on hand not only ample material but also a large staff of assembling mechanics. In the race that followed, the Canadian Aeroplanes Limited finished three weeks ahead—an illustration of the fact that the best type of organization is that which is not so wedded to one class of output as to be unable to adapt its methods and its plant to kindred, if varying, undertakings. So satisfactory was the work to the U.S. authorities, that it called forth the following letter from the American admiral in charge:—

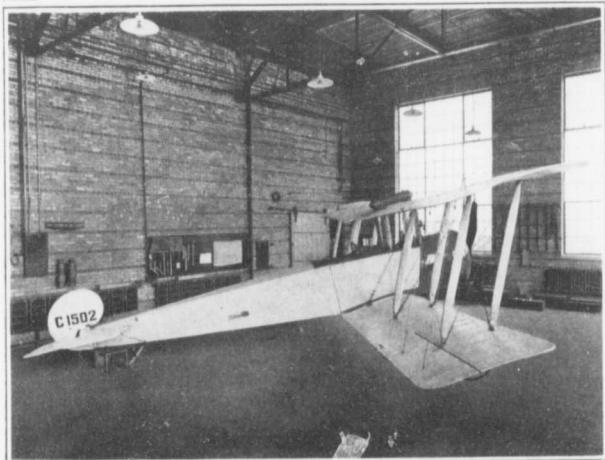
“On account of the excellent workmanship of Canadian Aeroplanes shown in the construction of navy flying boats, the bureau is glad to recommend the facilities of your plant, and it is hoped that additional work in aircraft construction may be secured elsewhere.”

The feat was not without effort. The thirty boats contracted for have been delivered, the first being turned out within three months from receipt of order. The shipments included spares to the extent of one additional boat in every three, exclusive of hull. It was not necessary to engage any additional staff, but it was necessary to give the training required to convert the aeroplane builder into the boat builder. This construction filled in a period between orders for machines for the Royal Air Force, but it involved the purchasing of special material from the United States, in which market the U.S. competitors of the company were already firmly established.

Boat building was, however, but a side issue of the primary purpose of the organization. It was formed to supply an Imperial brigade with ample and satisfactory aeroplanes. That this was done is unquestionable; but it is questionable whether those responsible for its organization and those under whose guiding hands it grew so amazingly foresaw the proportion the business was to assume or the peculiarly intimate relationship it established with the work



TEST OF FIRST C.A.L. MACHINE.



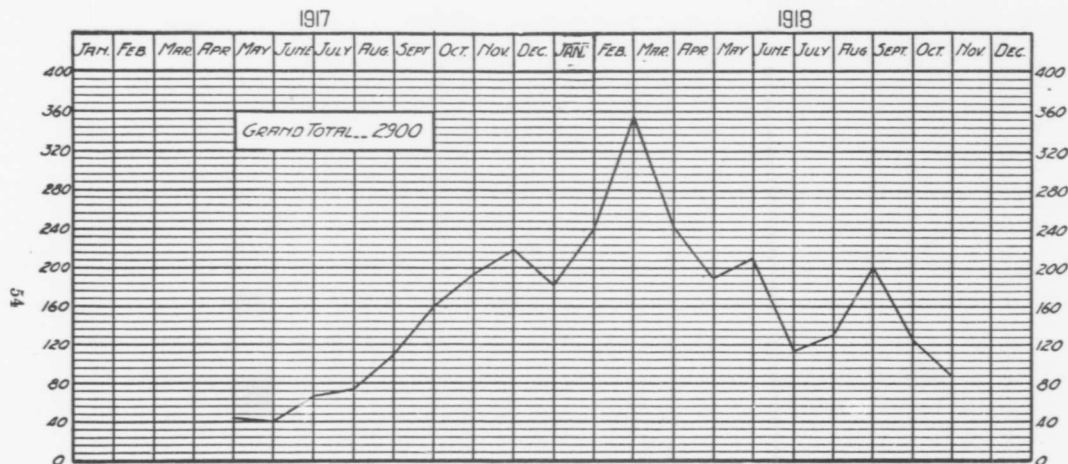
FIRST AVRO MACHINE OF C. A. L.



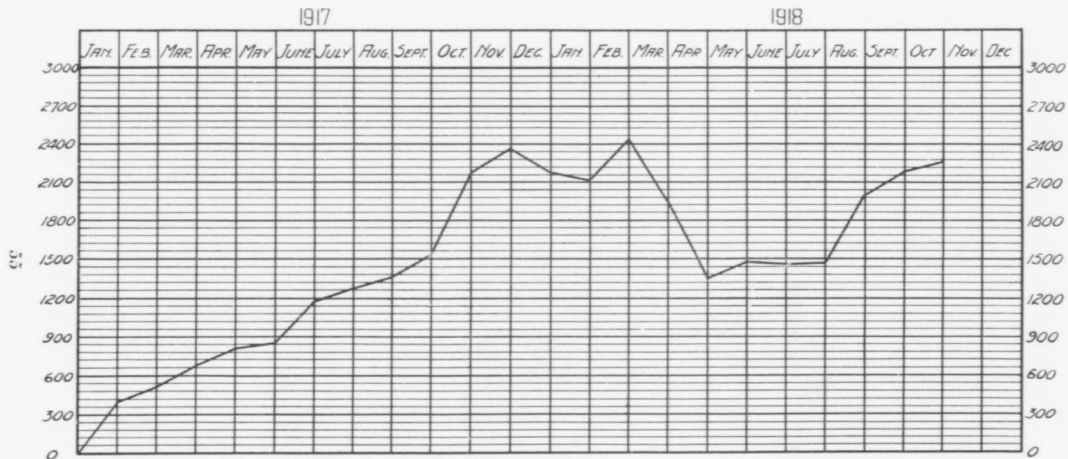
FINISHING PROPELLERS

of the brigade. The various reports of the General Officer Commanding on this subject pay unstinted tribute to the excellence of the service rendered. More than this, it is due to the qualities of the Canadian JN4 machine as manufactured in Toronto by the Canadian Aeroplanes Limited that training in flying by the Royal Air Force was so advanced that it covered the practice of all aerial manoeuvres and "stunts" possible on any machine.

In the graphs on pages 54 and 55 will be found certain data of interest giving the progress of manufacture, etc., but the essential figures are those not written. They are to be found, if computable, in the service rendered to the Empire by some three thousand pilots who first took to the air in machines made by this great national plant.



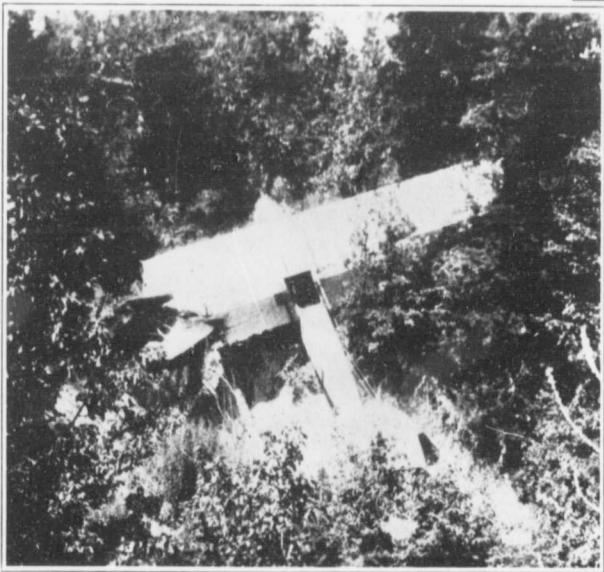
CANADIAN AEROPLANES LIMITED - MONTHLY OUTPUT OF MACHINES
 IN ADDITION 30 FLYING BOATS FOR U.S. NAVY



CANADIAN AEROPLANES LIMITED - MONTHLY STRENGTH OF EMPLOYEES



A WOODLAND SCENE.



A COMFORTABLE CRASH.

THE COST OF TRAINING

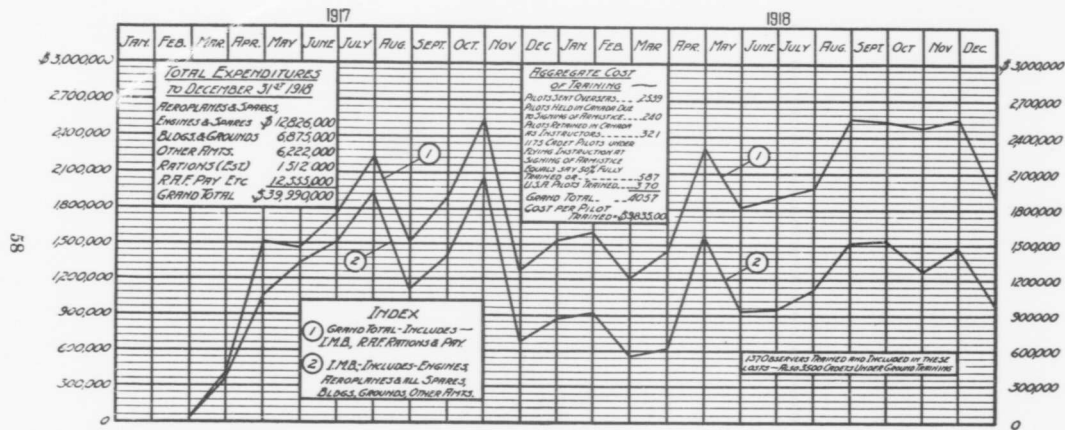
Herewith is given a diagram presenting the net cost of the work of the brigade in Canada. The disbursements indicated include the total of all sums paid out both by the Corps and the Aviation Department of the I.M.B.

This cost, being \$9,835 per pilot trained, will, it is estimated, be reduced to \$9,660 when the various assets of the brigade have been liquidated. It will be seen that no amount has been apportioned against the complete training of 137 observers, and the partial training of 3,500 cadets who were on the strength and in various stages of ground tuition in November, 1918.

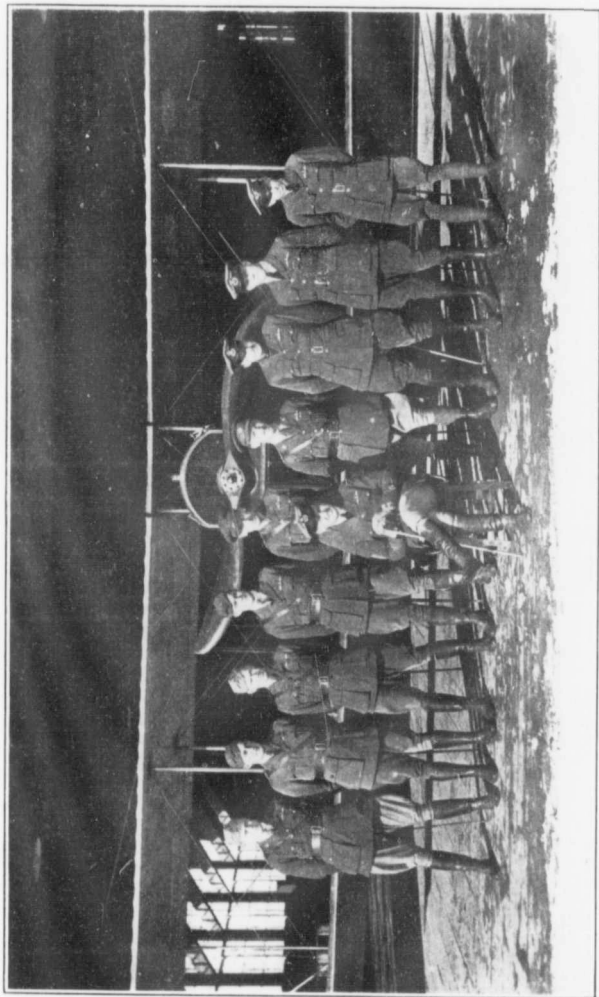
From December, 1917 to April, 1918, both brigade and Imperial Munitions Board expenditures show a decrease. This is due to the fact that for these months the cost of aeroplanes, engines, spares, etc., were met by the U.S. Signal. Service, for whom the Corps trained a large number of pilots. The amount thus saved by the Corps may be considered as approximately equal to that spent on the partial training of 3,500 cadets and included in the gross sum mentioned.

The increase in outlay by the Imperial Munitions Board in the autumn of 1918 was occasioned by a large building programme, designed to accommodate the entire brigade in winter quarters, no further move to Texas being contemplated. When hostilities ceased this accommodation was practically finished.

It will be noted that the winter of 1918 found the brigade with its capital expenditure complete, and subject only to such maintenance charges as rations, pay, repairs, etc. Had training, therefore, been continued, it is without doubt that pilots would have been turned out at a cost very much less than that above indicated.



R.A.F. CAN.-MONTHLY DISBURSEMENTS AND TRAINING COSTS



OFFICERS, 81ST SQUADRON, CAMP RATHBUN.



HEADQUARTERS OFFICERS AND STAFF.

HEADQUARTERS STAFF.

The duties undertaken by the headquarters staff of the Corps were, in many respects, much more onerous than those which fall to the lot of a similar establishment in Great Britain, and comprised not only the routine work of the brigade, but also very many functions which under home conditions would have been assumed by either the War Office or the Air Ministry.

Looking back at the past two years, it appears that although the headquarters burden was thus increased, the arrangement proved distinctly to the advantage of the Corps, resulting as it did in the centralization of authority and a constant unity of purpose and procedure which otherwise would have been difficult of achievement.

To make the matter perfectly clear, the Royal Air Force, Canada, must be considered as a unit operating outside the boundaries of the usual activities of the Air Ministry, and endowed with special authority and freedom of action, but handicapped, nevertheless, by certain limitations, which, although greatly alleviated by the helpful attitude of the Canadian authorities, made it imperative that extreme care should be used both in policy and action.

It is obvious from the chapter which deals with the matter of recruiting, that particular judgment had to be used in the means adopted to bring the Corps up to the necessary strength, and it was doubly important that every precaution be taken to avoid enlisting men who were subject to the provisions of the Canadian Military Service Act.

Only in very special cases where the applicant's qualifications made the enlistment desirable, was any recruit signed on who came under the provision of this Act.

The organization and formation of units was, of course, constantly subject to fluctuations in recruiting, and that these units were so soon brought up to workable strength, speaks well for the care given in this respect.

The arrangements made between Brigade Headquarters and the Department of Militia and Defence in Ottawa were all important; and negotiations for medical service, rations, etc., etc., having been completed with satisfaction to the Canadian government, it fell to headquarters staff to maintain a constant and careful liaison with the various departments involved. In addition there were also many important conferences at Washington, these resulting in a complete understanding between the U.S. Signal Service and the brigade, which understanding took admirable shape in the reciprocal training agreement so successfully carried out by the Corps in Canada and Texas.

Responsibility for training in Canada lay with the officer of headquarters staff on this duty, and constant touch was maintained with Great Britain in order that the methods of the Canadian unit might always reflect every recent advance in the system adopted.

Reference has been made elsewhere to the excellent service given by the Curtiss engine and Canadian JN4 aeroplane. This machine became out of date a little later, but such were its qualifications of strength and manoeuvring capacity, that, during the more recent period of the work of the brigade all pilots were sent overseas with flying instruction practically complete, needing only an introduction to machines, which although faster and more modern, were able to perform few manoeuvres which had not already been done on the JN4.

Owing to the fact that one-half of the personnel of the brigade was in a constant state of flux, and moving forward from unit to unit, additional work was thrown upon both the Records and Quartermaster's



LT.-COL. J. RUBIE



LT.-COL. F. R. G. HOARE



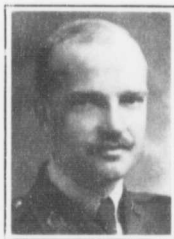
LT.-COL. A. K. TYLEE



MAJ. O. C. MACFHERISON



BRIG.-GEN. C. G. HOARE, C. M. G.



MAJOR O'REILLY



MAJ. J. M. MITCHELL



MAJ. H. B. DENTON



CAPT. C. J. BLACKMORE

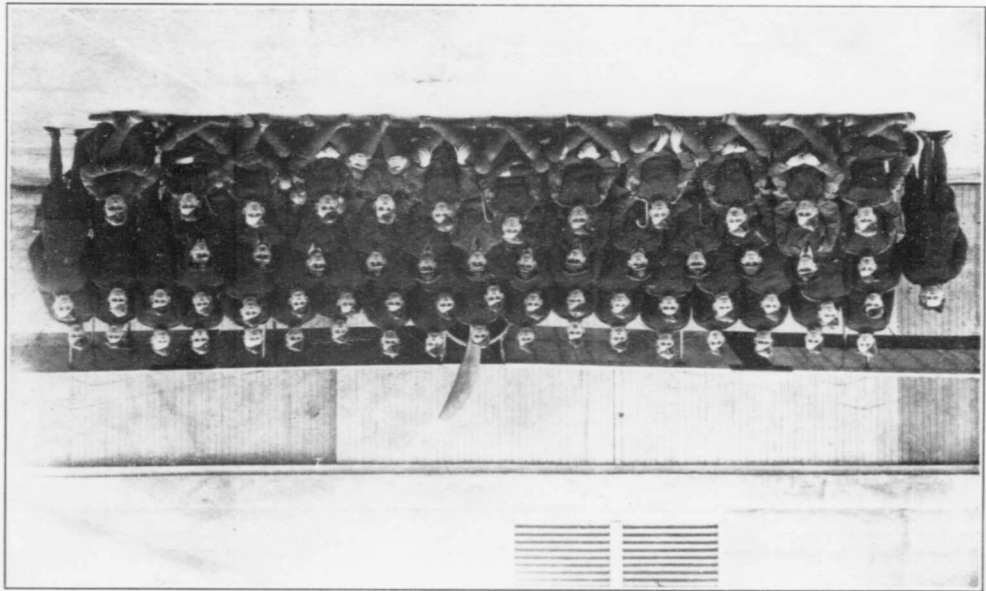


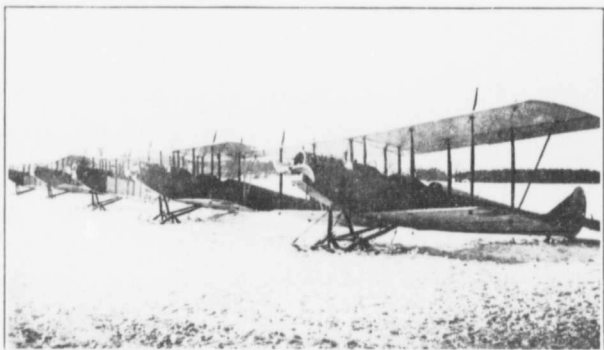
MAJ. M. A. SEYMOUR



MAJ. J. INWOOD

SIXTH SQUADRON, CAMP BODDEN—OFFICERS AND MECHANICS





READY FOR THE AIR. ✓



THE TAKE-OFF—WINTER FLYING. ✓



SCHOOL OF AERONAUTICS—CANTEEN. ✓



DINING HALL. ✓

department, and the prompt manner in which these organizations adapted themselves to the changing needs is worthy of mention. The move to Texas created an involved situation which was made workable only by a very special effort and complete coöperation with the Imperial Munitions Board, and, in spite of the strain thus occasioned, the success of this move must always be recalled with particular satisfaction by those responsible for its arrangement.

The Quartermaster branch discharged, as well, the duty of a Quartermaster-General's department, this being but one instance out of many in which the obligations of individual sections of the brigade were enlarged till they paralleled the work elsewhere performed by the Air Board or the War Office.

The composition of the Canadian units decided upon by the War Office, varied considerably from that of units already established in England, and, in consequence, the mobilization and equipment tables heretofore in use proved in most respects inapplicable to Canadian requirements. Thus there was thrown upon the Aircraft Equipment branch the almost unprecedented duty of compiling all the data determining every item of equipment to be supplied for carrying on the work of the Corps.

It was provided from the first that responsibility for price and point of purchase would be borne by the Aviation Department, and the burden of the A.E. branch ceased when requisitions were handed to the former. This, however it eased the situation, still left upon the A.E. branch the constant onus of working out in detail the entire list of engines and aeroplanes, with their multitudinous spares, and the complicated list of stores, technical and otherwise, requisite for the training of a continuous stream of pilots.

The records of the branch show that while the supply of machines from the Canadian Aeroplanes factory was invariably dependable, considerable diffi-

culty was experienced in securing deliveries of engines, and, on occasions, machines were sent to the wings without engines, the latter to be installed when received.

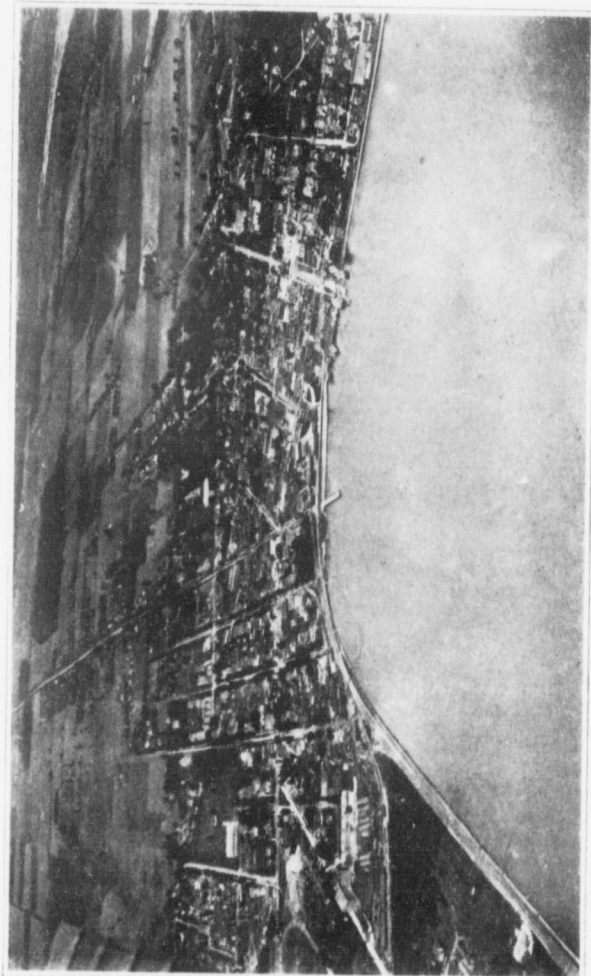
Motor transport being carefully considered, the original orders proved practically sufficient for all needs, and there was purchased only about one half of the equipment officially authorized. Had not the units at Beamsville and Hamilton been organized, the provision made early in 1917 would have proved sufficient. In the supply of aeroplane spares, the excellent service rendered by the repair sections of the various flying units in making broken parts serviceable, steadily reduced the monthly proportional outlay.

It is not possible in the scope of a page to go into the innumerable details, the solution of which rested with the A.E. branch. Sufficient funds were of course available, and an admirable coöperation with the Aviation Department of the I.M.B. always saved the situation—even sometimes at the last moment—but the difficulties overcome were very serious, and there were times when the imperative demands of the flying wings seemed almost impossible to satisfy. Added to this, there was increased difficulty in securing supplies after the United States entered the war and placed embargoes on many classes of goods. In spite of all, however, flying was never practically affected by any lack of material.

Since it is desired only to give an outline of headquarters duties, it is asked that the diagram on page 71 be referred to. The various subdivisions were found to be satisfactory and workable, and to reflect with accuracy those administrative needs on the fulfillment of which depended both the progress of the unit with its co-related branches, and the quality of the pilots it was privileged to turn out.



GERMAN AERODROME, WESTERN FRONT



BARRIE, ONTARIO, ✓

BRIGADIER-GENERAL C. G. HOARE, C.M.G.
General Officer Commanding

A.O. 1

LT.-COL. J. RUBIE
General Staff duties.
Organization and formation of units.
Discipline.
Establishments.
Arrangement for movement of troops.

Records—**MAJOR H. B. DENTON**
Recruiting all cadets and airmen and records of all non-commissioned members of the Force.

Works Section—

MAJOR O. C. MACPHERSON
Supervision of all structural and aerodrome work.

Discipline—

MAJOR C. R. HUGGINS
Courts martial.
Courts of enquiry re absentees.

CAPT. J. L. LANGMUIR
Assistant Provost Marshal.

A.O. 2

MAJ. J. M. MITCHELL
General routine.
General administration
Headquarters orders.
Officers' records.
Posting and employment of officers.
Promotions.

Medical Boards } **MAJ. O'REILLY**
Dental Services }
Organization and control of all medical services.

A.O. 2A.—**CAPT. F. D. WILLIAMS**
Pay and allowances.
Examination of unit orders.
Civilian claims.

Transportation Warrants—

CAPT. G. J. BLACKMORE

A.O. 1A.

LT.-COL. A. K. TYLEE
General supervision of training.

A.O. 1B.—**MAJ. M. A. SEYMOUR**
All Flying training; syllabus of instruction; courts of enquiry re flying accidents; reports and graphs re training progress; technical matters regarding flying (no material); technical training of officers, non-commissioned officers, cadets and men.

A.O. 1C.—**CAPT. W. H. FARNELL**
Photography; supervision of this instruction at all units.

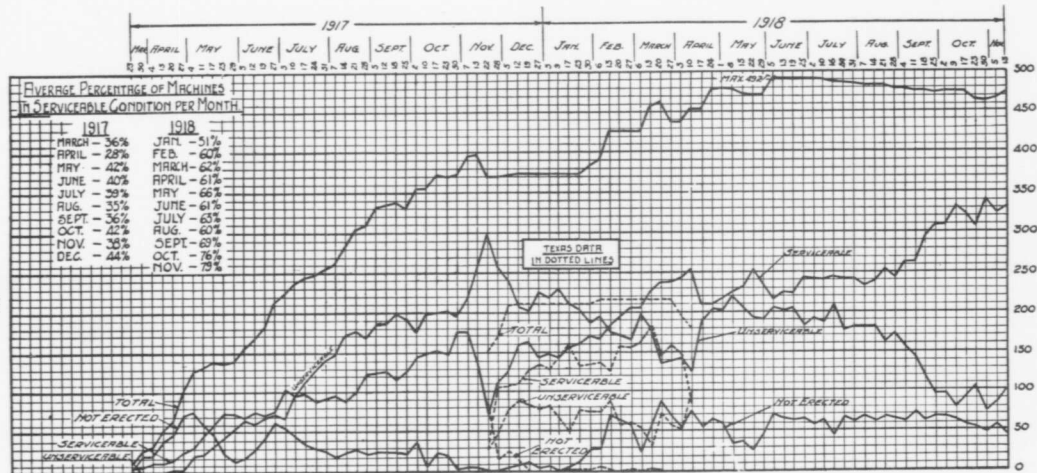
A.E.

COL. F. R. G. HOARE
Analysis and provision of all technical supplies

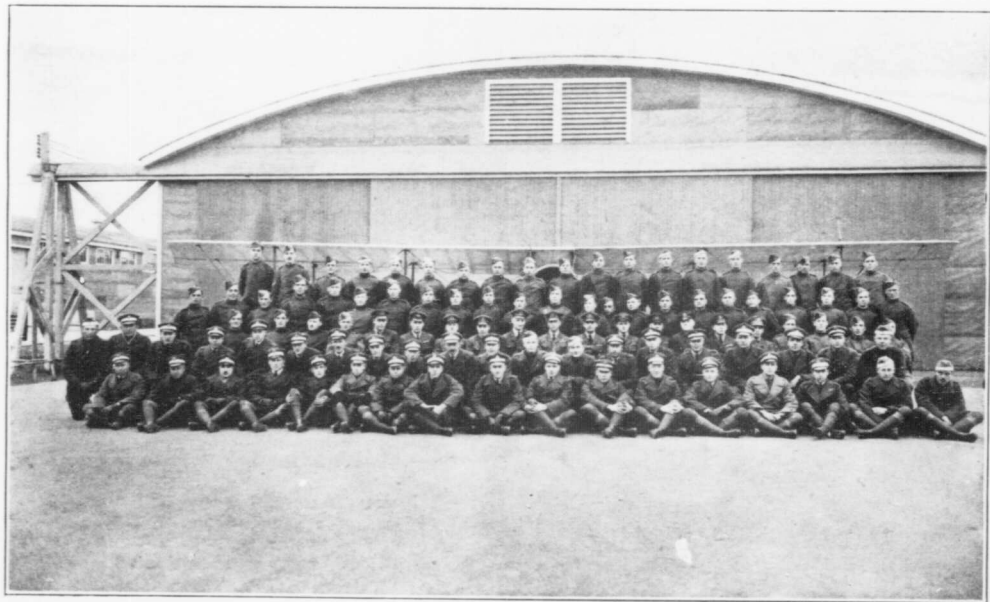
A.E. 1.—**MAJOR J. INWOOD**
Assisting A.E.

Quartermaster Services—

CAPT. G. J. BLACKMORE



RAF. CAN.-TOTAL MACHINES-MACHINES SERVICEABLE UNDER REPAIR AND BEING ERECTED
MARCH 1917 TO NOV. 1918



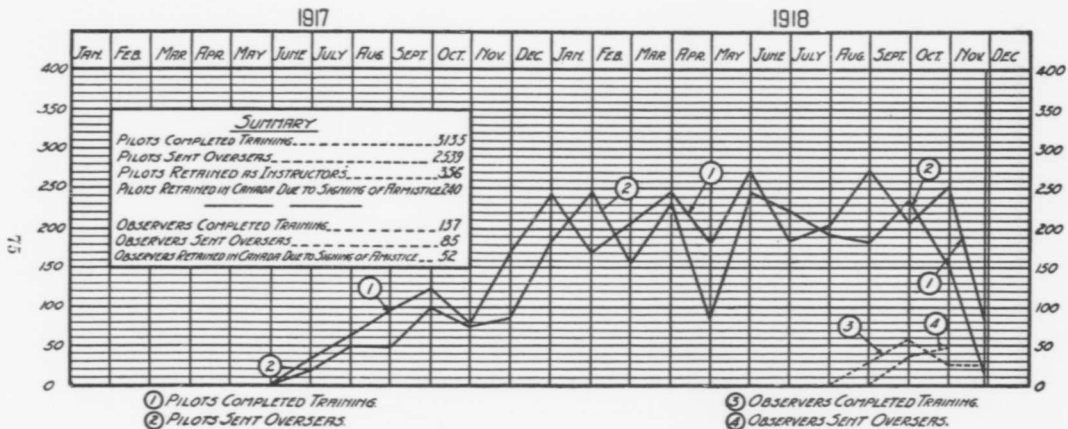
87TH SQUADRON, CAMP BORDEN.



Y.W.C.A.—CAMP BORDEN.



Y.M.C.A.—CAMP BORDEN.



RAF. CAN. OUTPUT OF PILOTS AND OBSERVERS

TRAINING IN GENERAL.

To achieve a brief review of the progressive instruction received by pilots and observers, it is unfortunately necessary to omit reference to many developments which from time to time built up the system finally secured. This is the more regrettable, since the foundations were laid under strenuous circumstances. Insufficient staffs provided with meagre equipment, much of which they themselves had to evolve, did notable service at a time when the demands upon them were constantly increasing. It is hoped, therefore, that those to whom the brigade is indebted for a vast amount of admirable and constructive effort will realize the impossibility of any descriptive detail concerning it, and will find in the ultimate methods adopted the essential fruit of their early labours.

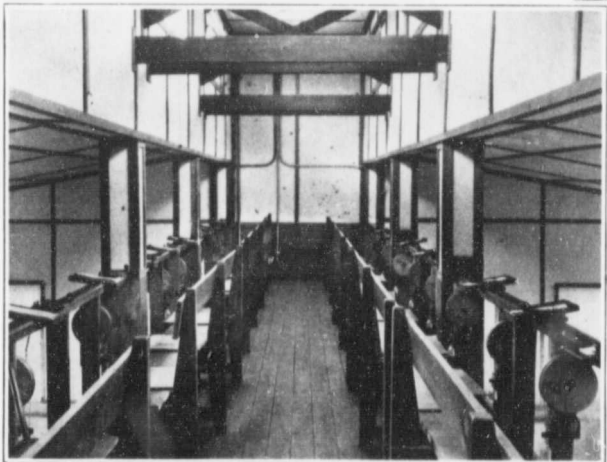
To the photographic record of training on these pages it is now desired to add certain data concerning the routine of instruction.

The cadet enlisting in the Spring of 1918 proceeded to the Cadet Wing at Long Branch after passing through the Recruits Depot, where he received an initiation into infantry training and buzzing (telegraphic receiving and sending) up to his ability in the period. Here he was clothed, equipped and given lectures on personal hygiene, discipline, and the primary features of the R.A.F. This course did not exceed two weeks.

During the eight weeks at the Cadet Wing the pupil's horizon broadened. He found also that every inducement was offered to proficiency and hard work, for instruction continued even in hospital, provided he was fit to receive it. Sports and physical exercise kept him in condition, and leave was frequent.



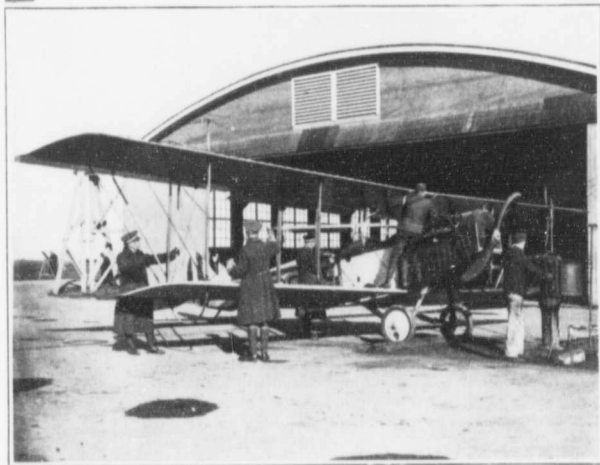
PHOTOGRAPHY.



ARTILLERY OBSERVATION SENDING STATIONS.



TESTING RIGGING.



FILLING UP.

His wireless was carried on to receiving and sending eight words a minute, and instruction was given in such a way that he was untroubled by the presence of the cadet beside him, because that cadet received and sent with a different wave length of transmission current. Panneau (see illustration on page 199) was read at four words a minute and practice alternated with the use of Aldis signal lamps. Ground strips, reproduced electrically in miniature, required correct reading. The method of locating flashes (symbolic of shell bursts) on clock coding target (page 158) demanded special attention to the point of locating ten successive flashes.

Came then aerial navigation, the knowledge of which is essential to all who travel by air. An extremely interesting study this, covering sketching, compass work—both magnetic and prismatic, definitions and conventional signs used—in fact all such information as is necessary not only to read intelligently and quickly any civil or military map and absorb the information often so vitally necessary, but also to construct one which shall be legible for general military and artillery purposes.

It follows, then, that the cadet when he arrived at the School of Aeronautics had already moulted much of the civilian. The plumage of the pilot was beginning to sprout.

At this point his education was carried still further. He applied his map-reading knowledge to an immense reproduction of part of the actual theatre of war, showing whole battlefields in faithful outline. He studied the plotting of an aerial course from point to point, with a given wind velocity and speed of aeroplane. He delved into air and weather conditions in northern France and learned what targets looked like when seen from the air. He began photography, the study of artillery work, zone call systems and those simple yet enormously important and pre-

arranged signals between battery and aeroplane. Here, too, he was introduced to the science of bombing.

Moving on to engines of various types, he absorbed their principles of design and operation—with practical work on the engines themselves which were set up on running stands at Camp Leaside and subjected to every temporary indisposition imaginable in order that the pupil might diagnose and remedy the trouble (page 83). With the engines he studied the design of the aeroplane, assembling and dismantling till its structure became simple and familiar (page 172). Coincident with all this was his education as a soldier, with lectures in military law, procedure, the organization of various arms of the service, the internal economy of R.A.F. squadrons, wings, parks and depots and the various phases of active service duty.

Congested as it may appear, there was in actuality no congestion. This was due not only to the fact that instruction was invariably progressive, but also such mechanical inventiveness had been displayed by the staff that whenever practical instruction involving mechanics of any nature was given, there was always produced the relative mechanical device which showed the practical application of the theory and demonstrated quite unmistakably its physical character.

From the School of Aeronautics to which further reference is made (page 162) the cadet proceeded to the Armament School. In the chapter under this heading his course is sufficiently outlined, and by the time he arrived at a flying wing he had mastered the theoretical and mechanical essentials of the principles and appliances which were to control his further development.

It was recognized that if instruction in wireless ceased on arrival at the wings, the pupil at once became rusty in these requirements, and, from the commencement of the Corps, work classes were invariably held in this and kindred subjects at all flying units.

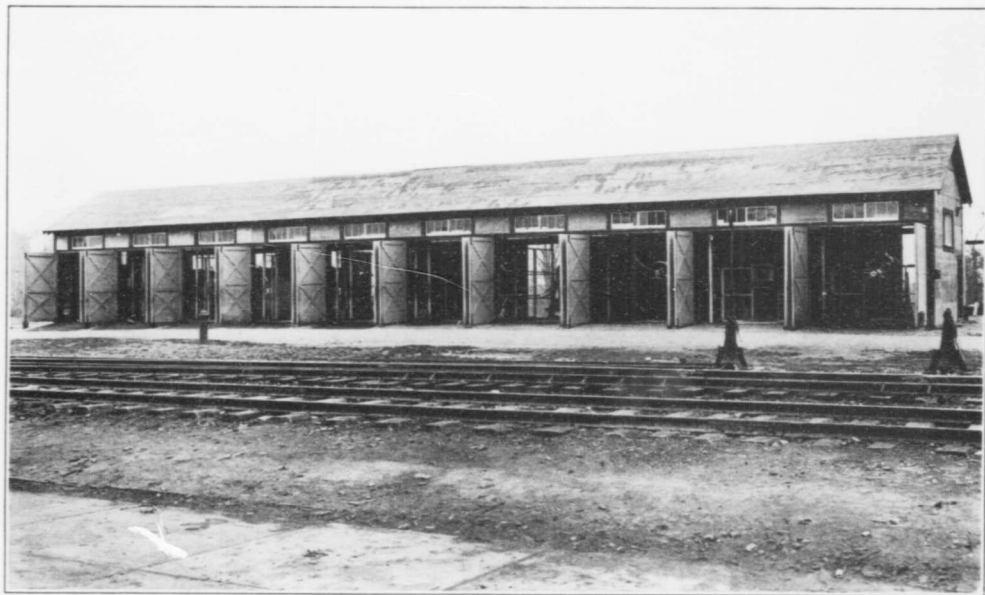
Now came the time to which the cadet had been looking forward since his enlistment. Entrusted to a competent instructor, he embarked on flying tuition. Here also was practice in aerial photography, vertical and oblique, and bomb dropping by wireless, in which the pilot signalled the release of an imaginary bomb, the message being received by an observer in a camera obscura hut, who noted also the position of the machine at the instant of release. Formation and fifty-mile cross-country flights were practised, the former as in active service, the latter giving opportunity for map reading in the air, and the actual collection of a variety of information which paralleled the duty to be performed at the front.

Here, too, the cadet climbed to 6,000 feet and remained at this height for fifteen minutes. He flew through clouds guided by compass, read ground strips and Aldis lamp signals, and in general comported himself exactly as though in the air over enemy country, and when he ultimately reported at Camp Leaside it was as a skilled pilot thoroughly at home in his machine and ready for the two final periods of his instruction.

At Leaside, the 43rd Wing, came final tuition in artillery coöperation. Here the cadet absorbed to his capacity all that science and a particularly brilliant system of instruction could give him. The picture target of former days was reproduced on a huge scale, and from work on this the pupil took to the air. From an altitude of 2,000 feet he noted bursts presumed to be those of batteries, located them on his map and wirelessed their position to the receiving battery station, correcting and directing its fire. Information was sent down describing the effect of barrage fire, the movement of troops, the location of wire and similar details. Contact patrol work was studied, as was indeed every feature of artillery coöperation duty, even to the wearing of gauntlets when sending wireless.

All through the period of training his physical condition was regarded as of prime importance; and continual exercises, so arranged as to develop every bodily power, and, in consequence, every mental activity, were faithfully practised. The result was a human mechanism, fit and alert, sound and responsive, and capable of being brought to the highest possible pitch of efficiency.

At the School of Aerial Fighting came the last step in the development of the pilot. Armed with Vickers and Lewis guns he went through a final course of ground gunnery which demonstrated the problems and mechanics of the art of shooting to the last degree. Taking to the air, first with another pilot, he shot at full-sized silhouettes anchored in Lake Ontario a mile from shore. Later, armed with a camera gun loaded with film, he undertook aerial practice on a brother cadet, the developed film showing the accuracy of his aim. Aerial tactics were carried out, and every imaginable manoeuvre of attack and escape has been observable for months at this most interesting of camps. Finally, equipped mentally and physically, with all that the British Empire could do for him, he left for either overseas as the highest product of the R.A.F., Can., or to the School of Special Flying to be tested as an instructor, an equally arduous but more thankless undertaking.



ENGINE TEST SHED—LEASIDE.



OFFICERS' MESS—LEASIDE.

NORTH TORONTO.

The North Toronto wing was the third flying station of the brigade to go into action. It was subdivided into two units, Leaside and Armour Heights, the ground for the former being most generously offered free of charge by the York Land Company and the town of Leaside; while for the use of the latter area the Corps is indebted to F. B. Robins, Esq.

Actual construction commenced on May 21st. Leaside, comprising 222 acres, presented an admirable surface which was carefully drained. The structural programme called for nine flight sheds, together with instructional and repair buildings, etc. At the close of hostilities there was accommodation for 89 officers, 230 cadets, 83 warrant officers and sergeants, and about 600 rank and file, the latter being housed in a large factory building, the use of which was secured from the Leaside Munitions Company. In the autumn of 1918, work was commenced on a central heating plant serving the officers' and cadets' quarters.

The territory north, east and west of Leaside presented a country with fairly large fields and but little wooded land, and there was in consequence every opportunity for forced landings. As this station was the main point at which training was given in artillery coöperation, a most complete system of observation huts connected by telephones, was constructed and dotted the countryside for miles around.

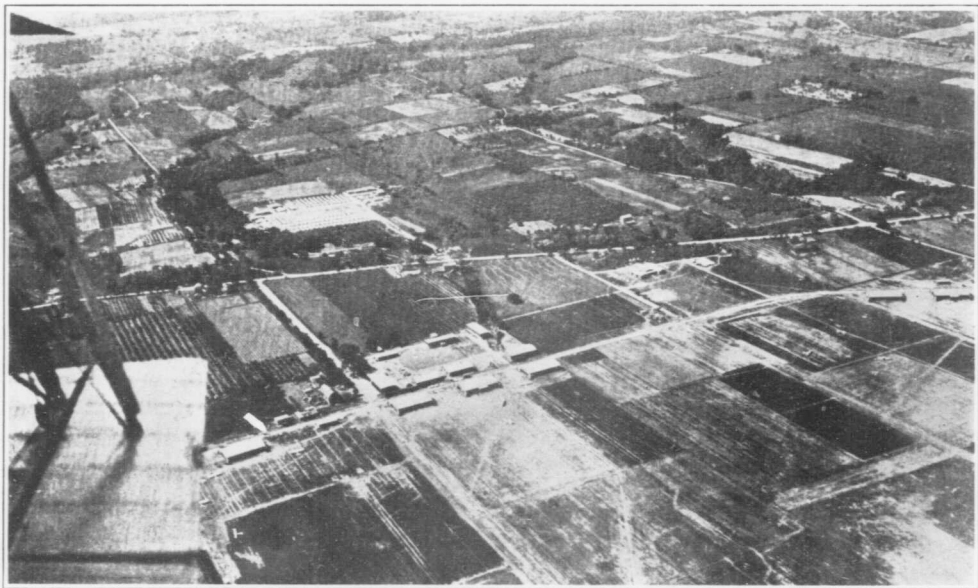
Leaside has always been a point of interest to visitors on account of its proximity to Toronto, and has had the honor of inspection by H.R.H. Prince Arthur of Connaught and the Duke of Devonshire, at that time Governor-General of Canada. From Leaside also started the aerial mail which, under the auspices of the Aero Club

of Canada, made several trips to Montreal and Ottawa, and demonstrated the great advantage that will no doubt accrue from the use of aerial transport for this purpose.

At Armour Heights were the squadrons detailed to give instruction in what is known as the Armour Heights course. The aerodrome lies some five miles north of Toronto. Here accommodation was provided for 58 officers, 56 cadets, 32 warrant officers and sergeants and 188 rank and file. The type of building and general arrangement of the station did not present any features varying noticeably from other camps, but this unit was always the object of much interest to visitors on account of the advanced flying at all times observable. The output of instructors here graduated has been vital to the success of the Corps, and the keenness and enthusiasm displayed was undoubtedly fostered by the brilliant example set by the flight commander who for many months was in charge. His record has been worthily maintained.



PART OF AERODROME, LEASIDE.



PART OF BEAMSVILLE AERODROME.

BEAMSVILLE CAMP.

The site of the School of Aerial Fighting was selected in the autumn of 1917. Actual preparation of some 300 acres comprising the aerodrome began, and the work of building was in full swing by December. Climatic conditions approximated those at Camp Borden some twelve months previously, it being a winter of severe cold and high winds, but so earnestly was construction pushed that the camp stood ready for occupation when the School of Aerial Gunnery, as it then was, returned from Texas at the beginning of April, 1917. This provision did not at the time include barracks for cadets and rank and file.

As will be understood, complete equipment was provided for gunnery practice, the several ranges running from 25 to 200 yards. These were furnished with a diversity of targets for surprise deflection, miniature aeroplane and disappearing target work, the type of butt here constructed proving extremely satisfactory.

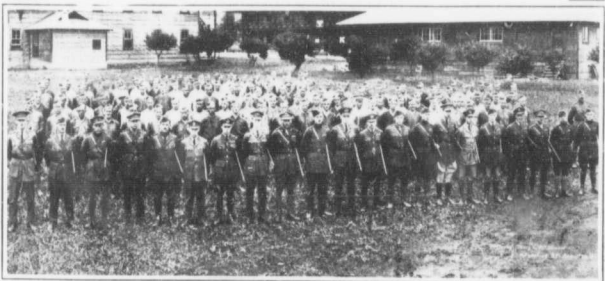
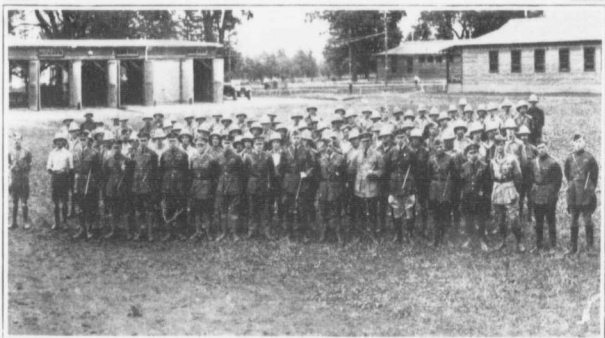
Full sized silhouettes of machines, riding on anchored rafts, were also set out in Lake Ontario a mile or so from shore, it having already been established in practice over Lake Worth, Texas, that firing over the water was of great value, owing to the accuracy with which registration could be made and also the excellent opportunity given of arriving at a proper diving angle. Beamsville provided all such advantages, and practice was further stimulated by the use of a fast armour-clad launch, which, travelling at top speed, offered an unusually good target.

As work developed, it became clear that the School was in point of fact one of tuition in aerial fighting, the practice of tactics forming a large part of the instruction given. Its nomenclature was in consequence altered in July, 1918.

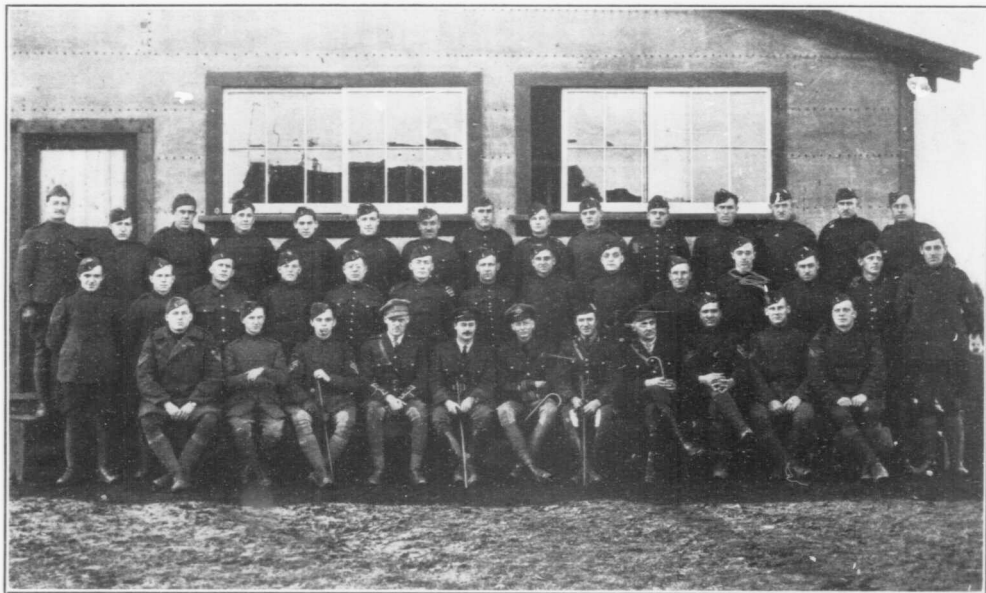
In the summer of this year, a fourth squadron was organized and housed, and steps taken to provide permanent accommodation for all ranks. This programme included additional officers' quarters, and the construction of about a dozen large buildings on the hillside which previously held the tents of the unit. The work had just been completed at the date of the armistice, when the accommodation at this station was sufficient for 122 officers, 400 cadets, 96 warrant officers and sergeants and 768 rank and file.

Other services covered an excellent supply of pure water from the lake, a complete drainage system, and ample electrical facilities from the circuits of the Dominion Power and Transmission Company of Hamilton, from which city Beamsville is some twenty-three miles distant to the eastward.

The trip from Toronto by air was always of interest, paralleling the south shore of Lake Ontario to the long sandspit that cuts off Hamilton Bay from the main lake, along this curving bar and thence over orchard and vineyard along the edge of the great escarpment over which, a little further eastward, plunges the Niagara River. This area is appropriately called the garden of Canada, and the unit found itself fortunate in its surroundings.



OFFICERS AND STRENGTH, SCHOOL OF AERIAL FIGHTING, BEAMSVILLE.



GROUND INSTRUCTIONAL SECTION—CAMP MOHAWK.

INSPECTION.

The Aeroplane Inspection Department took the responsibility of determining whether every aeroplane and every engine bought by the Royal Air Force, Canada, complied with the rigid requirements laid down as necessary before acceptance. That the duties of this organization were, in point of fact, admirably carried out, is evident in the splendid results secured by the brigade in flying duty.

The A.I.D. was, under another name, in actual existence in Canada before the arrival of the Corps in January, 1917, being then engaged in supervising the manufacture of machines made in Canada for the Admiralty by a branch of the Curtiss Aeroplane Company situated in Toronto. The work at that time was under the Director of Inspection for the Imperial Ministry of Munitions.

The coming of the Royal Flying Corps to Canada, and the consequent demand for the supply of large numbers of engines and machines, made it advisable that the unit should reap the fullest possible advantage by the expansion of inspection work into an organization, the first duty of which would be vouching for the quality of aeronautical supplies purchased. In order that the work of this Department might be kept absolutely up to date, constant touch was maintained with the Ministry of Munitions in Great Britain, and information regarding every new development was invariably transmitted to Canada without delay. Thus it has been possible that the factories in Canada producing aeroplane material were kept modernized by the best known methods of inspection.

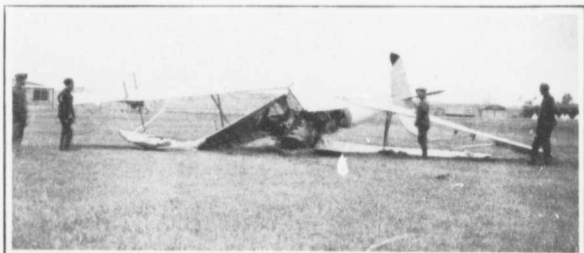
It will be evident that the term inspection was something more than a name. All raw material of every description entering any factory for the manu-

ufacture of aeronautical supplies subject to the Aeroplane Inspection Department, is held until a release note is given by the latter, the release note only being issued, in the case of sheet metal, for instance, when a sample has been taken from every sixth sheet and analysed with satisfactory results. In the case of steel tubing, of which a great deal is used, every tenth tube is dealt with likewise, the same minute method being impartially applied to all material received.

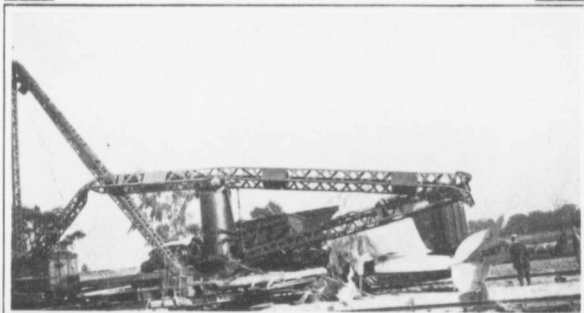
As manufacture progresses with the material which has been passed, the manufactured parts themselves are subject to a second inspection, and are not allowed to be sent on to the assembling department unless up to requirements. A common sight in such factories is the supervisor's metal cage, and it is on record that through one cage passed no less than 150,000 metal parts in one week.

Lastly comes inspection of final assembly; this formerly applied to every machine, but rigging and adjusting before leaving the factory was ultimately reduced to every sixth, results being found acceptable. Here the same rigid method was carried out, and examination release sheets were filled in. If results were satisfactory, these were signed by the Aeroplane Inspection Department, and a copy passed on to the Aircraft Equipment Branch of the R.F.C., the latter refusing each and all deliveries not thus vouched for. So satisfactorily had the system worked out, that at the request of the brigade the Aeroplane Inspection Department installed their representatives to pass upon the work of the Engine and Aeroplane Repair Parks of the brigade.

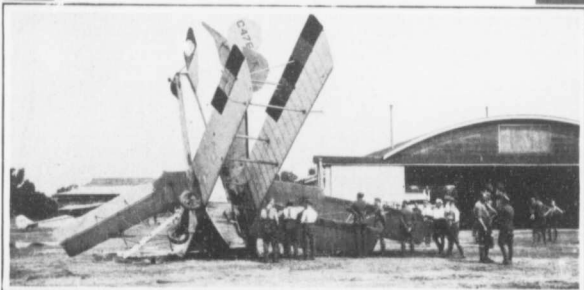
In British Columbia, the A.I.D. gave valuable services by the passing of all aeroplane lumber purchased by the Imperial Ministry of Munitions for aeroplane purposes, and from this source was drawn raw material required by Canadian factories. The quantities handled were very large, as much as four



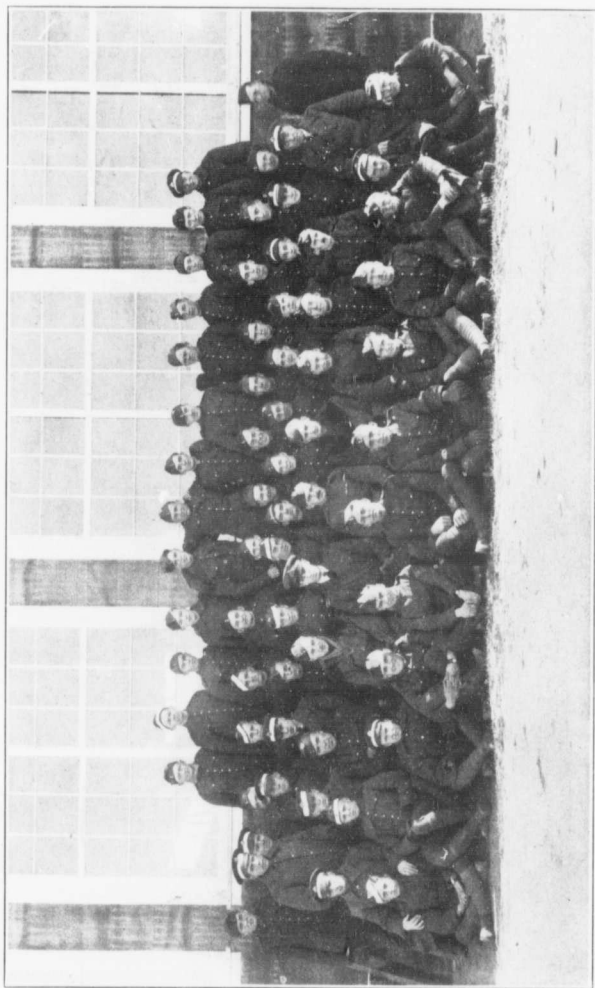
"A PANCAKE."



WHAT A MACHINE DID TO A DERRICK—
PILOT UNHURT.



COLLISION.

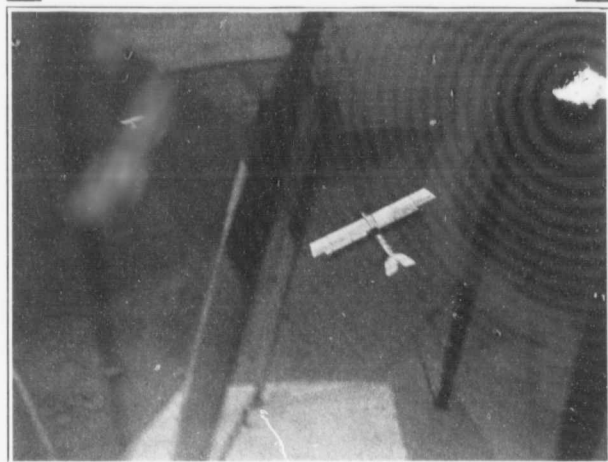


942ND SQUADRON, CAMP BORDEN—OFFICERS AND MECHANICS.

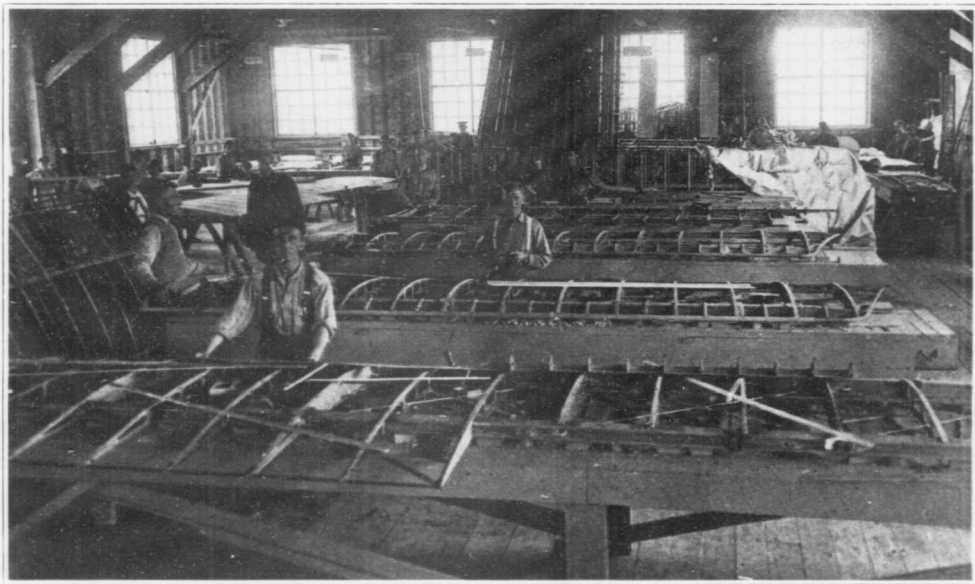


FORMATION.

GLIDING HOME.



MACHINE SEEN THROUGH A VERTICAL "BANK,"



AEROPLANE REPAIR—CAMP MOHAWK.

and a half million feet being inspected in the course of a month. Other services were the supervision of the manufacture of the many engines purchased by the brigade from the Curtiss Aeroplane and Engine Company in the United States.

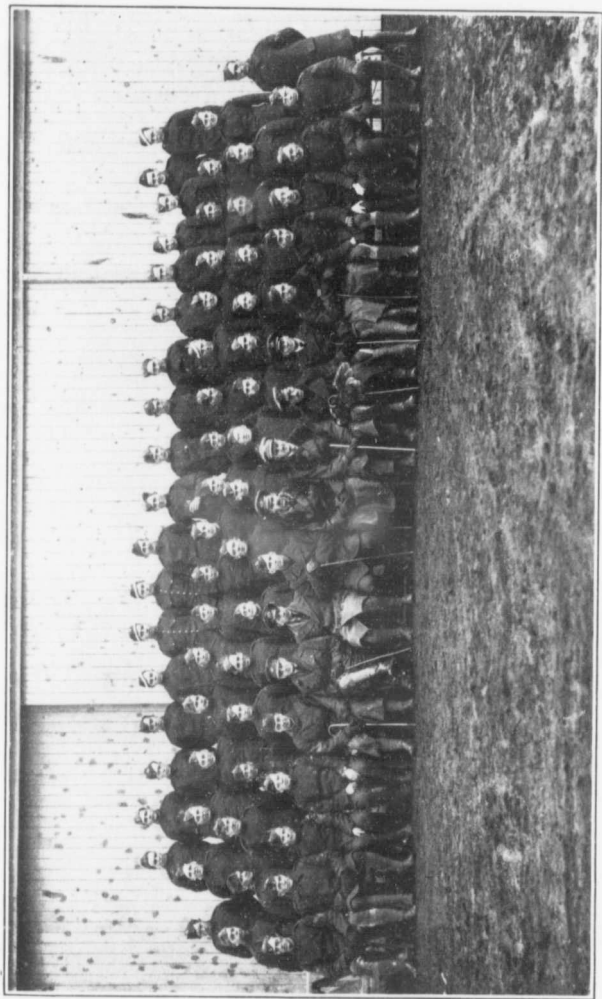
In order that there might be a thorough consensus upon all technical questions, there was formed shortly after arrival of the R.A.F. an Aircraft Advisory Board. This consisted of representatives from the factory, from the R.A.F. and from the A.I.D., and dealt with the question of any changes required or contemplated in machines. It is hardly necessary to add that no alterations were actually made without conference between the Board and the A.I.D. The chief inspector states that always and under all circumstances the greatest possible harmony has existed between his organization and that of the R.A.F.

THE INSTRUCTOR.

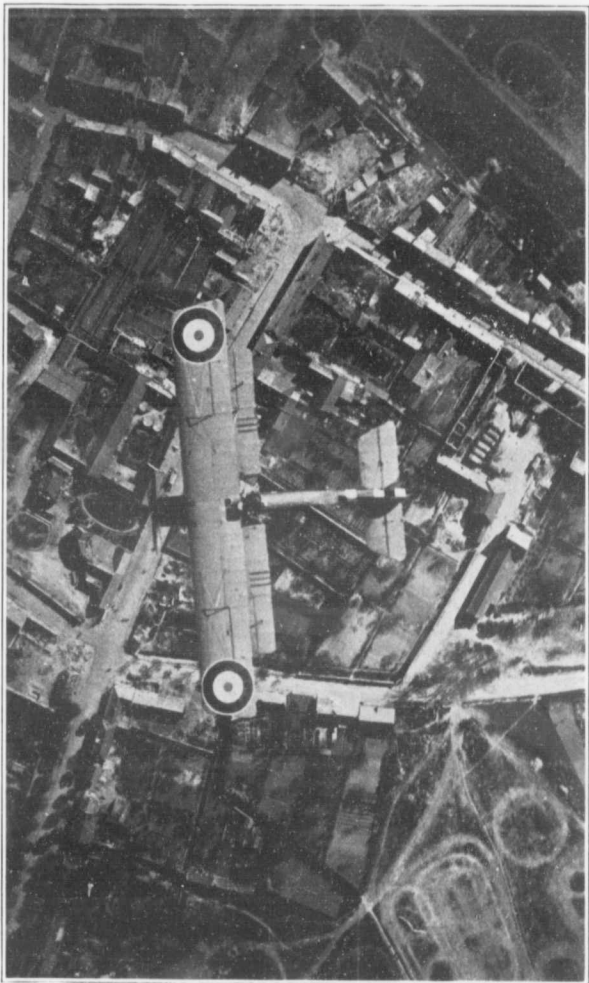
Flying instructors are, for the most part, too good to be sent overseas. This is a bald and possibly astonishing statement. The rest are usually those who, being incapacitated at the front from further active duty, spend the rest of their service imparting valuable knowledge to others. From which it may be seen that the appointment is highly honourable as well as arduous.

In the early days of the R.F.C., Canada, the job was not as exacting as in the later months of the R.A.F., Canada. The instructor was then a man who could fly. To-day he is still a man who can fly, but has, to boot, a peculiar and well developed art of infusing his own skill and courage into the pupil by following a certain recognized procedure which has been demonstrated to be the last word in training. There is nothing in this derogatory to the early instructors. Their work was admirable. In a sense they took even greater risks, owing to the slight preliminary training then afforded to pupils before going up. But the instructor of to-day is one who himself has been instructed not only in the mechanics and dynamics of flight, but also in that inductive process by which he acquires the complete confidence of his pupil. It will be understood therefore, that on the introduction of the more modern system of training, to which reference is made on page 211, it was necessary to re-examine all instructors and make sure that their abilities equalled the new requirements. In addition it was constantly necessary to be sure that instructors were not growing stale in their work.

While there is undoubted fascination in flying, the sensation begins to pall after hundreds of hours in the air in a slow machine which circles somewhat monotonously over areas of which every detail has long



85TH SQUADRON—CAMP MOHAWK.



ON THE WESTERN FRONT.

since been memorized. The Canadian JN4 is considered reliable, with vagaries too slight to demand much attention, and a most excellent machine for instructional purposes. It is not as inherently stable as some others, but instruction on a stable machine would not have been as desirable as on one which required constant if simple control, and effected its higher manoeuvres by acquired momentum and not by engine power.

In Canadian flying therefore, per se, there is nothing particularly attractive for the instructor. The most unstable element is provided by the cadet, and it has been remarked that at the outset "he has many opportunities for error and usually discovers them all." To anyone who has observed a machine reeling unsteadily around an aerodrome under the guidance of a fledgling pilot, while his instructor sits impassively in the seat of danger, it will be apparent that the latter has attained an abnormal degree of pluck and composure. It is a point of honour with him not to assume control until it is obviously imperative, and even then there is danger lest the pupil, in an excess of fear, cling desperately to the stick and bring about disaster.

With the instructor must be placed the second in command of squadrons. To this officer falls the responsibility of conducting the "pool," through which all pupils pass before being posted out. Here take place those final tests which determine the cadet's proficiency. Failing in any one, the pupil is returned for further tuition. To this officer, therefore, the squadron commander looks for the ultimate approval of the work of every cadet, as well for the satisfactory condition of instructors and aerodrome discipline.

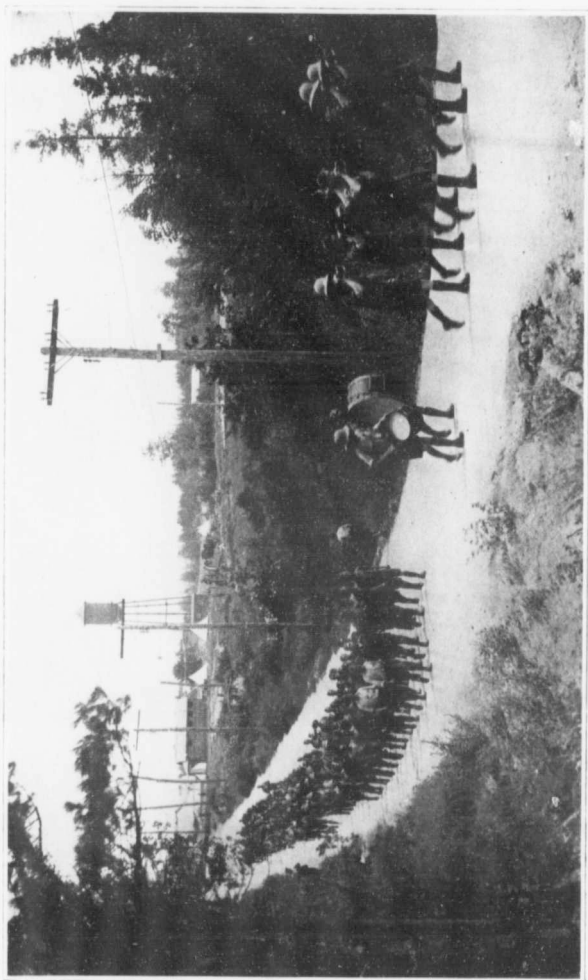
There are compensations, however, if no guarantee of personal security. To the instructor, for instance, there is always interest in the never-ending tide of cadets, their personalities, their characteristics as developed in the air and their progress. A cadet's

first solo flight brings, if successful, a peculiar pride to the man who taught him to fly, but if not successful a self-searching to determine what link in the armour of tuition has been weak—for the instructor is held responsible for the crash.

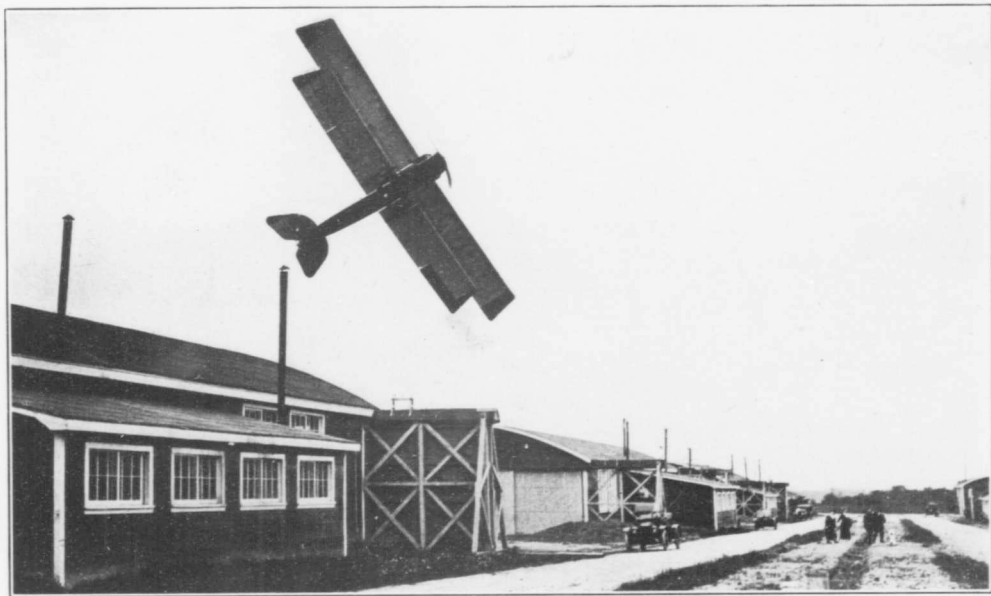
The wing examining officer was called into existence by the introduction of the Gosport system, which in itself has been developed and modified to suit Canadian conditions. The first result of this introduction was that it became necessary to comb out instructors, some of whom had been too long on the job and were "stale," others too old, others too young to be entirely steady, and others who, though excellent pilots, could not adopt the principles and psychology evolved. Still others needed instruction themselves. To this end the School of Special Flying was established at Armour Heights under a brilliant pilot. A steady supply of well-trained men was assured by the operations of this unit.

Early in the year 1918, the instructors at every wing were put under the wing examining officer, whose duty it was to weed out those who got stale, to test the abilities of all new instructors from time to time, and form his own opinion of their instructional capacity. In addition, it was the obligation of this officer, to investigate the log book of every machine which crashed, and demand an explanation of any apparent discrepancies, and also to keep knowledge of all crashes so as to determine whether any one instructor was responsible for an unreasonable number. In the case of the latter being evident, it was palpable that the instructor was either stale or too young for his work, and he was forthwith sent overseas, where usually under the new and much-longed-for stimulant he did admirably.

A mind of peculiar judgment is required to find its chief satisfaction in the achievements of others. This is demanded of all instructors. Deprived of the



OFF TO WORK—CAMP BORDEN.



“STUNTING” AT ARMOUR HEIGHTS.

tremendous incentive of contact with the enemy, isolated, as it were, in a daily repetition of duties that afford little variety, constantly speeding off others to that thrilling destination where they fain would be—others who owe to them their fitness to go—such is the every-day grind.

And yet how tremendously it has all counted! A large part of the work of the brigade was in preparing cadets to a point at which they were deemed worthy of flying instruction. Toward that honourable object was directed a vast amount of effort. Decorations were often subsequently won by pupils whose instructors plugged doggedly along the same old road. There was no publicity, and only junior—very junior rank. Here, therefore, is given earnestly and officially, the grateful thanks of the General Officer Commanding to those men who by their unfailing readiness and pluck have had so splendid a part in turning out the pilots the brigade has been privileged to send overseas.

THE MEDICAL SERVICE.

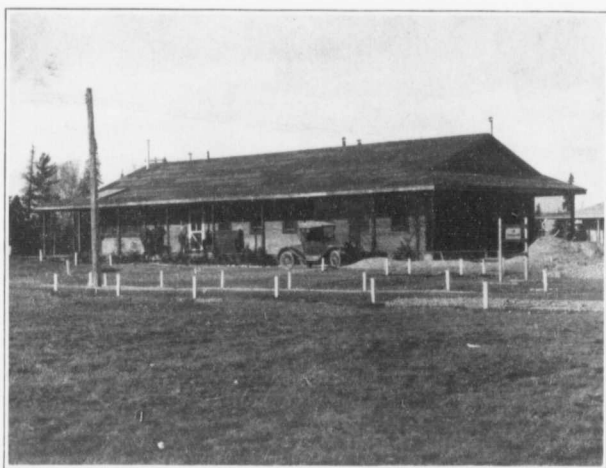
The R.A.F., Canada, is indebted to many Canadian authorities and organizations for assistance rendered, but to none is the debt greater than to the Canadian Army Medical Corps for supplying the personnel from which the medical service of the Royal Air Force has from time to time been built up. The request was made in January by the Imperial Government that the Canadian Militia Department should supply this service. Prompt action was taken, and from a small beginning there has been formed a complete corps of medical officers, medical orderlies and nurses, skilled not only in everyday practice but also in the special work called for at flying camps.

The original intention was to supply only a small camp hospital, with one medical officer and the necessary orderlies at the various aerodromes, but it was soon determined that the work of the Medical Corps covered a much wider range than was anticipated. Almost the first need was that of skilled orderlies who were specially trained in first aid. Owing to calls from overseas, the available number of men was very small, and it was found imperative that the senior medical officer of the R.A.F. provide the necessary training. Coincident with this came a further need of isolation hospitals, which, although the general health of the brigade was maintained at an unusually high standard, were found to be essential in order that the work of training might not suffer in the least degree.

The responsibilities undertaken by the medical department were made the more onerous, not only because an extremely low percentage of class "A" men were enlisted—and these only owing to their possession of invaluable technical ability, but also because the community at large suffered from severe



MEDICAL OFFICER AND STAFF, DESERONTO.



HOSPITAL—CAMP BORDEN.



"HUNGRY LIZZIE."

civilian epidemics of scarlet fever and influenza. Surgical work, with dental surgery—which latter covered many major operations owing to crashes resulting in broken jaws and teeth—comprised a considerable part of the duties performed.

A modern operating room was completely furnished at each aerodrome, together with X-ray equipment at the "out-stations." In the autumn of 1917, the medical orderlies were further aided by the introduction of nursing sisters. For these also we are indebted to the Canadian Army Medical Corps, and without question their work has been of the highest possible advantage. Thus, by degrees, the medical staff of the Royal Air Force increased its personnel, the burden of its duties and the value of its services.

Ambulance equipment was of prime importance. A Packard machine, provided with a special type of shock absorbers and every possible requisite, not only for first aid but also for fire extinguishing, was stationed at each field, and remained on constant and watchful duty from the time the first aeroplane took the air till the skies were empty for the night. So close was the lookout, that "first aid" was often tearing full-powered to the rescue before the crash completed its descent. The ground traversed being often rough and devoid of roads, it was imperative that the ambulances be perfectly cushioned, lest the condition of "shock" as frequently found in "crash" be aggravated by the journey home. It is hardly conceivable that there could have been found vehicles better designed for the purpose than those selected, and unquestionably lives were saved in consequence of their use. Chemical extinguishers and asbestos blankets, the latter introduced for protection of the pilot in case the crash was in flames, were also carried as part of the equipment.

For winter purposes at outlying stations, the aerial ambulances shown herewith were evolved. With a wide radius, landings could have been made in any

suitable, snow-covered place, however inaccessible by motor transport. They were never to be used by the R.A.F., Canada.

In this connection it is interesting to note the degree to which the duties of the medical officers in flying camps varied from the more or less regulated routine met with in other services. The senior medical officer has, from time to time, instilled into his staff certain axioms for their constant guidance. It has been, for instance, necessary that the medical officer in flying camps become, as far as possible, the confidant and adviser of all ranks. It is advisable that he himself get into the air as soon as feasible, and that the machine which carries him be put through all evolutions, in order to acquaint him with the physical phenomena of flying. No machine must leave the ground unless the medical officer on duty is within reach, nor must the latter leave the aerodrome while there is a machine in the air. A further responsibility is that he must pronounce upon the fitness of all cadets and flying officers to take the air, and, further, without hesitation, prevent any man from going up who is, in his opinion, unfit. As routine work he must also conduct a monthly physical inspection of all cadets, and be present at all "test flights."

The psychological side of medical service takes on new proportions in a flying camp. The personality and characteristics of the patient in question must be always kept in mind so that when investigating air sickness the medical officer may determine whether it is real or assumed. The question of fear, i.e., "aerophobia," in its actuality, and any loss of nervous control, must be established if existing—and obversely. Any excitement or tension must be carefully distinguished from natural recklessness or other characteristics of what is termed a "thrusting disposition."

An exhaustive study of the ideal pilot established the fact that he should have an acute and correct sense

of equilibrium. This does not appear so essential for an observer, who if he is fairly safe in the air and does not become giddy in stunting, may prove acceptable.

The "rotation tests," described in detail below, have proved that as regards a great number of successful pilots—referring to those who have flown 100 hours and more,—in no case has a man been discovered who has not conformed to the above standards laid down for admission to the brigade. Above all there is demanded a sound physical condition, by which alone all bodily functions will respond normally.

The following data are taken verbatim from memoranda issued by the senior medical officer and authorized by the G.O.C. for the information of medical and flying officers:—

"For the information of the flying officer, a short explanation of the phenomena of equilibrium may not be out of place. Deep in the bones of the skull, in close connection with the hearing apparatus, lie, one set on each side, a series of three minute canals, filled with a clear fluid and lined with a membrane intimately connected by delicate nervous elements with the brain.

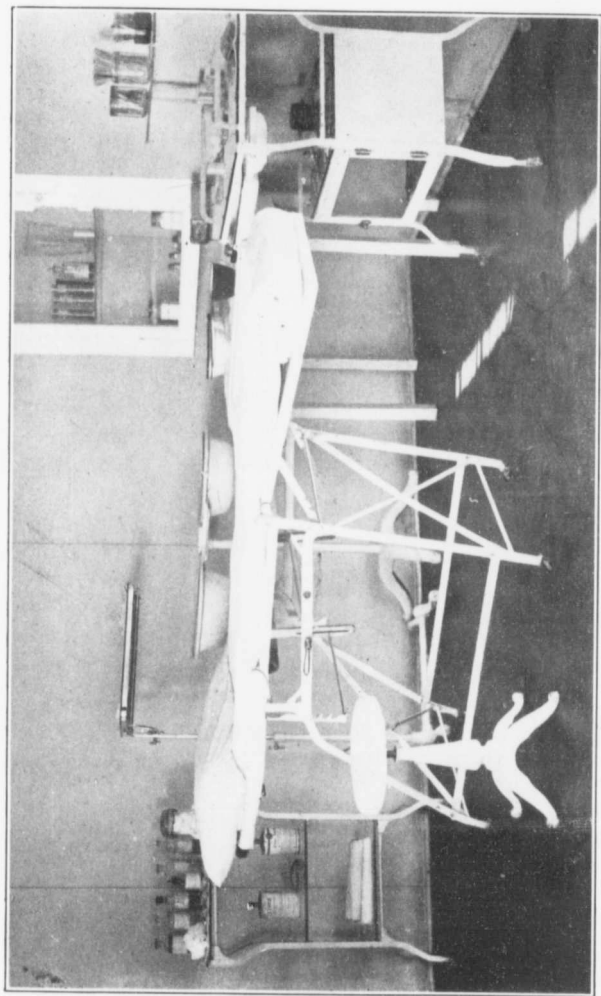
"These canals, each corresponding to half of the arc of a circle, are about half an inch in length, have a diameter of about one-twentieth of an inch and intercommunicate. They lie in the three dimensions or planes of space, and it is primarily due to movements in the contained fluid acting on the delicate nerve terminals, which are directly connected with the brain through fibres of the Vill nerve, that man is enabled to maintain the equilibrium of the body. It may be of interest to note at this point that the corresponding system in birds shows the extremely high degree of development one would expect. Knowing that to be a successful pilot a man must have an accurate and delicate perception of his position in

relation to the earth, it is readily seen how intimately the internal ear, its adjuncts, and the problems involved in aeronautics are related. It should be understood that the canals mentioned above have nothing to do with the sense of hearing.

"Close to these, and in the same portion of the bone, lie two others closely resembling the spiral canals found in conch shells, and it is on these canals, also filled with fluid and lined with cells connected to the brain by fine nervous filaments, that we rely for our auditory impressions. It has been proved that not only dizziness, but also nausea and vomiting, all untoward symptoms frequently encountered in airmen, are closely connected with lesions or functional disturbances of the labyrinth of the auditory apparatus.

"In order to test the action of these canals, the contained fluid may be set in motion by rotating the body. This is most readily done by seating the patient in a revolving chair, and so, with the head in different planes, testing the different canals in turn. It has been found that pilots experiencing difficulty in flying, especially in maintaining equilibrium, and those who are troubled with vertigo or nausea, often show abnormal reactions, and it is for this reason that these tests are employed. These 'rotation' or 'turning tests' have been used for a considerable time in connection with diseases of the internal ear and in the diagnosis of lesions of the brain, but it is only recently, as a result of experimental work, that their application to aeronautics has been demonstrated and proved to be of practical value.

"In the 'nystagmus test' the applicant is first spun in the chair exactly ten times in twenty seconds, accurately checked with a stop watch. The examiner now carefully observes certain lateral, jerking movements of the eyes which normally appear, but should cease on an average in twenty-six seconds. A certain



OPERATING ROOM, CAMP BORDEN HOSPITAL.



WINTER CRASHES.

variation is allowed from the normal time, and cadets for pilots not conforming to this test should not be allowed to fly. In it the head is tilted forward to an angle of thirty degrees in order to stimulate only those canals which lie in the horizontal plane.

"In order to stimulate those canals lying in the vertical plane, 'falling tests' are employed. The subject is instructed to lean forward, resting his forehead on his hands which are placed on his knees, and is then turned alternately to right and left five times in ten seconds.

"Should he be rotated to the right and be ordered to sit up, he should immediately fall to the right, which is the normal reaction, but should he sit directly upright or fall to the opposite direction, a faulty functioning of these canals or of the pathways in the brain is thus demonstrated.

"'Pointing tests' are applied somewhat similarly. The candidate is turned ten times in ten seconds alternately to right and left, with eyes closed. He is then instructed to raise his arm and point to a fixed object, usually the examiner's finger, of the position of which he is already aware. As a result of the dizziness produced, if he has been turned to the right, he should point to the right of the object. This 'past-pointing' is a normal reaction, and any considerable deviation will immediately reject the applicant. Even after the chair has stopped, the man still feels that he is turning and is endeavouring to locate the fixed point. The 'past-pointing' shows that he is attempting to allow for the rotary motion which he is still experiencing, though actually the chair is stationary.

"Since the more sensitive, theoretically, a man is, as shown by 'turning tests,' the more likely he is to be a good pilot, as he should be able to detect more accurately and early the movements of his plane without the use of his eyes. This is, however, true

only to a limited degree, for we have found that as a rule the higher the nystagmus time, the more likely is the man to suffer from vertigo, nausea or vomiting in the air. On the other hand, theoretically, a man with a short period of nystagmus should be less sensitive to unpleasant, subjective sensations, and those with 'dead labyrinths' ought to be immune.

"The practical deduction is that in good pilots the ocular oscillations must not vary to any considerable extent, say not more than ten to twelve seconds; on the other hand the lower or shorter the time the better a man should be able to stand the violent swaying of a captive balloon, since it is this motion above all others that produces the most intense nausea and emesis. Following the above to its logical conclusion, we in practice reject men who show too high a nystagmus time, and recommend for observers, and especially for balloonists, those showing sluggish reactions."

Failure to conform to either the pointing or falling reactions required are good and sufficient reasons to reject applicants for cadet pilots.

It is probable that to the layman much of the foregoing will be found technical and scientific, but to the investigator into the physical and psychological phenomena induced by flying, it should be of direct interest. In the medical service of the R.A.F., Canada, the value of these tests in their standardized form was first proved by their application to men who were actually unfit to fly, and the case sheets of many such are on file in that department.

Their adoption only followed after the analysis and continual checking of results obtained by tests not only upon those who desired to take to the air, but also those who, having flown, were reported by their instructors to be unfit to continue, and which showed that they were demonstrably correct, and not merely deduced from a *a priori* assumption.



REACTION AFTER TURNING TO THE LEFT.



REVOLVING CHAIR TESTS.



REACTION AFTER TURNING.



REVOLVING CHAIR TESTS.

Investigations into "oxygen want," as evidenced by drowsiness, shortness of breath, fainting, etc., at considerable altitudes, have led the authorities to supply pilots with oxygen tanks for use in high altitudes, since it is not the density of atmosphere but the dearth of oxygen which causes these distressing symptoms. An apparatus has recently been perfected by means of which, by diluting the respired air with nitrogen, it is now possible to determine accurately the altitude beyond which a pilot may fly in safety, and so it is hoped to prevent many casualties, and assist in the "classification" of airmen with reference to their flying capabilities.

Vision, which when abnormal causes headaches, dizziness, etc., should be normally stereoscopic, and the accommodation perfect in at least one eye; but while accurate color vision is considered desirable, it is not essential providing the primary colors are correctly recognized.

Amongst other tests adopted by the brigade are those giving the vital lung capacity, the expiratory force, also complemental and supplemental air, the former being the measurement of the excess capacity of the lungs over a normal intake of air, the latter that quantity of air remaining in the lungs after a normal expiration.

Excess of any nature is frowned on. Excessive tea or coffee drinking, or any semblance of nicotine poisoning at once asserts itself. The strain of instruction also produces definite phenomena, and pilots retained for this duty are limited to three and a half hours' flying daily. These phenomena are watched for, and treated sanely and sympathetically, till the individual with all his personal variations becomes as it were a human barometer, which infallibly records the actions and reactions of the flying man's life.

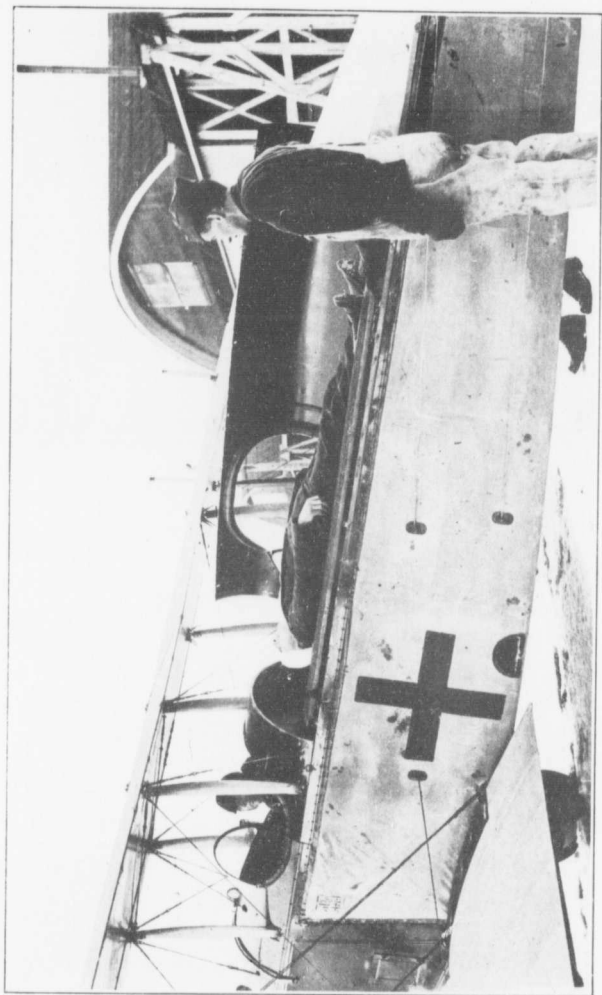
Owing to the fact that the pioneer attempt at systematic winter training, without regard to temperature,

was undertaken during 1917-18 in Canada and successfully concluded during the severest weather of many years, certain new problems required solution. When it is realized that machines flew at ground temperatures as low as -35 degrees Fah., the occurrence of frost bite and any effect of the intense cold on the mental faculties, to the extent of producing drowsiness and even stupor, was extremely infrequent. The flying clothing provided, the Hawker boots, the gauntlets and chamois face masks, which were adopted after all ointments, oils, etc., generally in use in altitude flying, froze *in situ*, most effectually prevented the expected difficulties, so completely indeed that during the whole winter season no serious casualties could be traced to the effect of the low temperatures encountered.

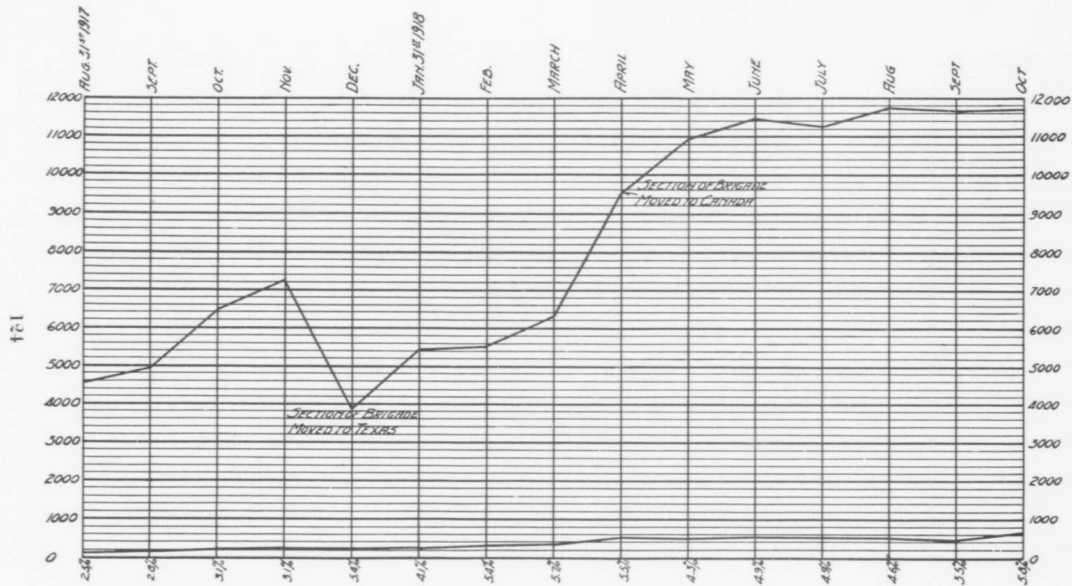
Such in brief outline are some of the major investigations peculiar to the duties of the medical staff of the brigade. To these are of course added others better known, such as blood pressure, etc. Couple them with psycho-mental problems, and they give some suggestion of the history compiled for every would-be pilot and observer, an intimate history unapproached in detail and interest by any other tabulation of personal phenomena.

In conclusion, it is desired that special acknowledgment be made of the exceptional service rendered by medical officers on the aerodromes, and by the staff of medical orderlies distributed through the brigade.

The hours of the former were long and arduous, the duties of the latter, for which they were trained by the senior medical officer and his staff, were manifold and pressing. That they were admirably performed is of common knowledge, but that their swiftness in succour and skill in first aid saved many a life, is known only to those who have been privileged to see them at work.



AERIAL AMBULANCE



R.A.F. CAN.-MONTHLY STRENGTH IN CANADA AND PERCENTAGE INCAPACITATED BY ILLNESS

WINTER FLYING.

Prior to the operations of the Corps, it was generally assumed that the obstacles to intensive training in a snow-covered country were almost insuperable, but in the light of last winter's experience it is difficult to imagine the limit to which the aeroplane may not safely be used in the latitudes of the far north. Its apparent fragility, the exposure of the pilot, the fact that a large percentage of accidents occurred in making landings, and the mental picture of a machine floundering through snowdrifts in an attempt to rise, all seemed to reduce the matter to an impossibility. To-day it has been demonstrated by the work of the 44th Wing of this unit that, with such provision as has already been proved suitable, the aeroplane will rise from a snow surface more easily than from bare ground at temperatures far below zero, land in spots inaccessible in summer time, and that the pilot may be maintained in physical comfort and security and practically immune to the weather.

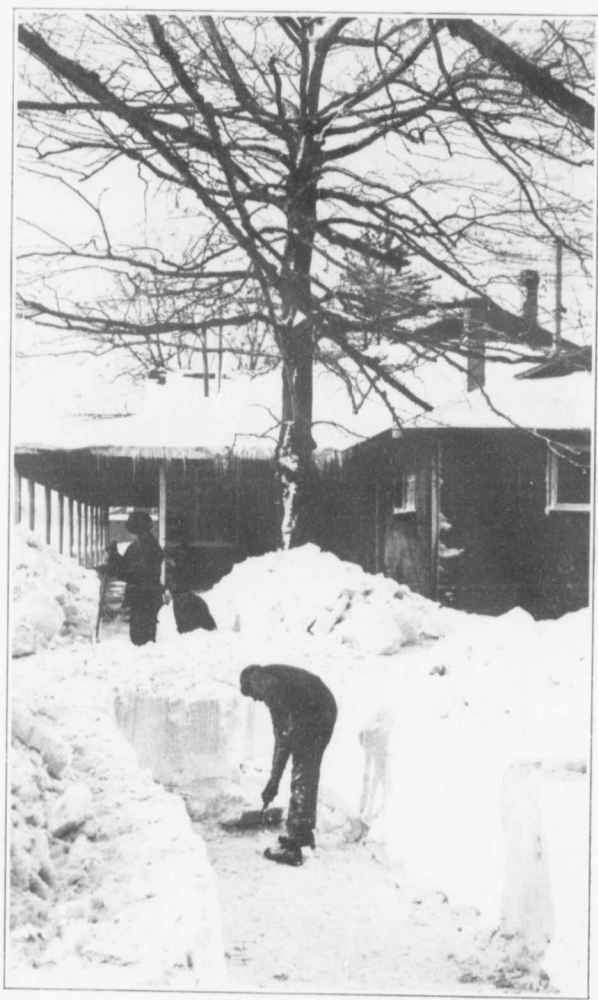
The process was one of return to aboriginal principles, in that there was adopted a method used by the North American Indian, since first he traversed the frozen waste. Experiments soon evidenced that under-carriage wheels were out of the question in snow more than six inches deep, and by the elimination of things that rotated and the adoption of things that slid, the aeroplane fell, so to speak, into line with the winter customs of the country. The progressive experiments out of which were evolved the skids finally adopted, called for the united suggestions of the unit, the Repair Park and the Canadian Aeroplanes Limited, but passing over the investigations into proper length, width, anchorage, bow curve, and kindred points, the result was an effective and curiously attractive combin-

ation of ancient and modern. As seen in the illustration on page 130, this gives the machine a semi-naval appearance—prophetic perhaps of the early union between the air forces of land and sea in the R.A.F.

Once in regular use, the efficiency of these shoes became very noticeable. The slight bump observable in the best of landings smoothed itself out into a gently cushioned settling in which the actual first contact with the snow was imperceptible. Similarly, in taking off, the sensation was as in a toboggan darting without friction down a steep slope. Breakage in propellers and undercarriages became reduced to a minimum, and frequent landings soon ironed out the white expanse of the aerodrome to an unusually good surface.

The protection of the pilot was of prime importance to continuous training, and since flying was carried on at temperatures much below zero, particular attention was given to guarding against frostbite. Whale oil, vaseline, etc., smeared on the skin gave only partial results, and it was not till long flying boots coming to the thigh were provided, and chamois masks covering the face, with holes for eyes and mouth were also issued, that comfort was finally attained. Thus the pilot could remain in the air for a much longer period, and perform instructional work with ease. The unit lacked the electrically-heated clothing issued on the Western Front, but it did not suffer in consequence. There were variations, of course, in the powers of resistance to cold, it being found that some pilots could endure low temperatures much better than others—and this called for the particular attention of the medical officer on the aerodrome.

As to the engines themselves, but little trouble was experienced. What did materialize was met by precautions somewhat similar to those taken in motor car work under parallel conditions. All petrol, oil and



LEASIDE IN WINTER.

VERBODENE CAMP MOHAWK.



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A WINTER CRASH.

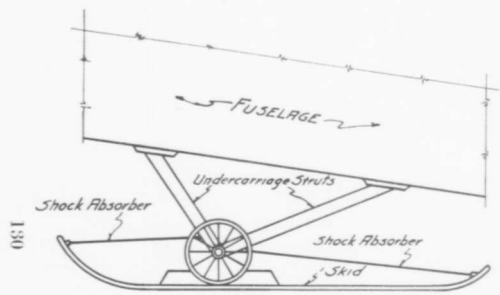


FIG.1

EXPERIMENTAL

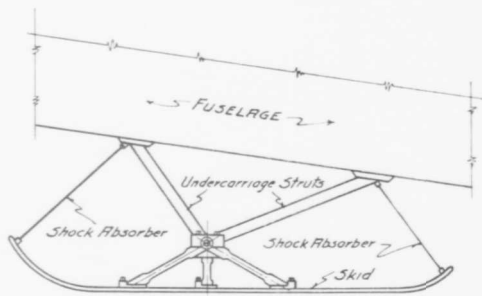


FIG.2

ADOPTED

R.A.F. CAN.-WINTER FLYING SKIDS

water were carefully drawn off every evening, the two latter being heated when replaced. Radiators were three-quarter covered by beaver board lined with felt, this plan working quite satisfactorily. Inspection of rigging was particularly close, lest the extreme cold should have set up undue stress in tension members, but the JN 4 seemed born for the duty, and so far as records go, no accident took place which is in any way attributable to mechanical failure brought about by low temperature.

It was decided also to make certain slight changes in tail construction should flying be carried on for another winter. This consisted only of enclosing the tail skid in a flexible cover at the point where it left the fuselage—to prevent snow from accumulating inside the latter.

Further protective measures were very simple, such as wrapping water connections with felt and fabric, and removing the oil gauge from rear to front seat to shorten the piping, and leading it between the cylinders to secure maximum warmth. For the rest, the hangars were banked with earth some two feet high, and maintained at a temperature not below fifteen degrees of frost.

That the programme was successful may be seen from the fact that though the winter was of unusual severity, both as to cold and snowfall, flying was carried out for twenty-six days in January, twenty-one in February, and twenty-five in March. For these months, the records give an average day temperature of twenty-six degrees, twenty-two degrees, and seventeen degrees above zero, respectively, with a minimum of thirty-five degrees below. During this period, some instructors kept up an average flying time per day of two hours and twenty-five minutes for the whole three months.

On this record it was decided that the training of all squadrons should be carried out in Canada for the following winter. This has proved unnecessary. The campaign is over. But who will now scout the prediction that the far North has no barriers which the explorer may not surmount with ease and swiftness, and no secrets which shall not soon be revealed to his enfranchized gaze.



RECORDS AND RECRUITING STAFF, ROYAL AIR FORCE,
 228, NEWINGTON GREEN, S.E. 1914



RECORDS AND RECRUITING STAFF, ROYAL AIR FORCE,
 228, NEWINGTON GREEN, S.E. 1914

RECORDS AND RECRUITING OFFICERS AND STAFF.



RECRUITS' DEPOT—JESSE KETCHUM BARRACKS, TORONTO

RECRUITS' DEPOT.

This unit, formed on February 5th, 1917, was first stationed in the Givens Street School, Toronto, which building was also partly occupied by the 228th Canadian Regiment. Recruiting, however, was active, and the R.F.C. began to show such strong signs of the marked popularity it was to attain later, that extra accommodation was soon required, and Crawford Street School taken over.

During the summer, it was seen that even this accommodation was insufficient. The Depot, therefore, moved out to Leaside, and under canvas.

The strength, at this time about 400, was largely increased by the arrival of four American squadrons to be trained by the R.F.C. These were attached to Recruits' Depot for rations and accommodation. It is satisfactory to remember that this first contact between the two corps was productive of an admirable comradeship which has existed ever since. It is noted also that canteen profits greatly increased, and a large percentage of these was handed to each American squadron on its departure.

The quartermaster's branch of the Recruits' Depot being still at Givens Street, it was realized that much extra clerical and other work would be saved could the whole depot be centralized. Steps were therefore taken by headquarters to acquire convenient barracks in town.

Early in September, the Recruits' Depot band was formed—largely helped by surplus canteen funds. It has been a source of much pride and also of a certain amount of amusement to the men of the depot. All parties for Texas or the United States were "played" down to the railway station, and the band and "Bruno" (the camp dog—a handsome St. Bernard) invariably accompanied the bi-weekly route marches.

In October the need of permanent accommodation in town became urgent. It was eventually found (owing to the great generosity of the Board of Education, Toronto), at the Jesse Ketchum School—a large and commodious building, which was completed as fast as possible, and loaned absolutely free of cost, including the larger part of the park attached to the building, which it was permitted to use as a parade and sports' ground. This consideration was only typical of the way in which Toronto public authorities have invariably dealt with the Royal Flying Corps.

The Depot moved into town on the 17th November, 1917, and was in good workable shape by the middle of December.

To these barracks, cadets, for the first time, were sent for preliminary training, and three or four hundred were thus added to normal strength, which stood at about 700. The ordinary accommodation proving insufficient for this number, double bunks were placed in all the sleeping rooms, where high ceilings and good lighting made the provision entirely feasible.

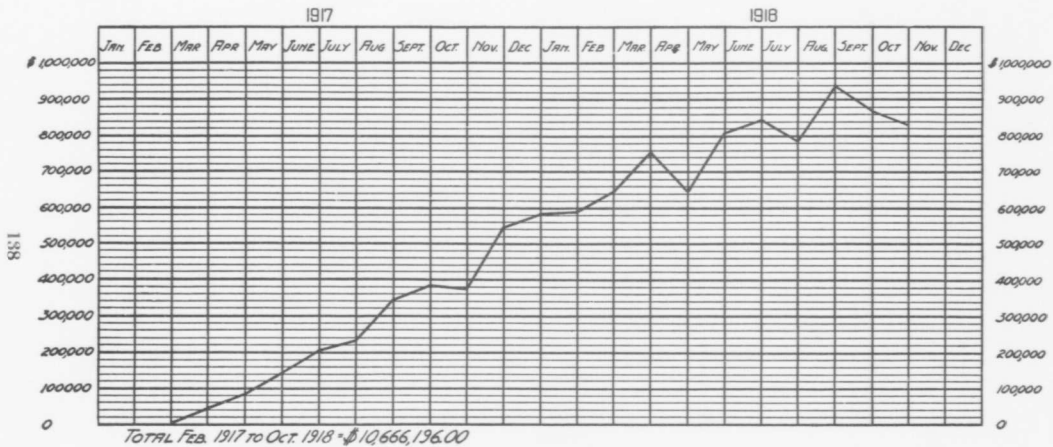
The band at this time was a first class organization, and in great demand for dances and hockey matches—half the profits made being allotted to the Longwood Convalescent Home. Concerts were held in the canteen three times a week. As to exercise, an ice hockey rink was made, a football ground rolled out, and three billiard tables put in the canteen, the electric lighting of the rink being given free of cost by the City Parks Commissioner. There was, therefore, no lack of amusement or exercise throughout an unusually severe winter.

The routine of procedure has been briefly as follows: Upon arrival at the Depot, all recruits reported to the non-commissioned officer in charge of the receiving room, and were allotted sleeping accommodation. Medical parade for final approval was held each

morning at nine o'clock, and an hour later recruits received their regimental numbers as "finally approved." Came a parade at quartermaster stores for issue of kit. Transfer clothing statements and clothing ledger being signed, all reported back immediately to the receiving room for the numbering of all articles of kit now in their possession. Civilian clothes were packed and sent to any address the owner might wish, and recruits were turned over to the barrack orderly sergeant who "carried on."

On discharge, the procedure is practically reversed, and all men report to the postings department, for the checking of documents. These being correct, sleeping quarters are allotted in space set aside for this purpose. The same day, kits are laid out for inspection, and inventories taken under the supervision of an officer. These, being signed also by each man concerned, are sent to the Quartermaster's office, and checked against the original clothing statements. Deficiency slips—should such result—(showing articles deficient, if any, and their value) go then to the postings department, to be checked against pay and mess book. This information is sent to the officer in charge Records, on receipt of whose signal that discharge may be proceeded with, an order is issued to the contractor for civilian clothing to provide authorized civilian outfit. The man's kit is turned into the Quartermaster's store No. 4, where another inventory of articles is made and forwarded to the Quartermaster's office, to be again checked against the original clothing statement. Forms showing actual shortages of kit are submitted to the Paymaster and a copy of Can. 638 (Particulars on Discharge) to the Pay Department.

Since the inception of the brigade approximately 16,000 men have passed through this unit. The process of demobilization will require the above procedure of discharge to be applied to a strength of not less than 12,000.



RAF. CAD.-PAY ALLOWANCE AND CADET SUSTENTANCE

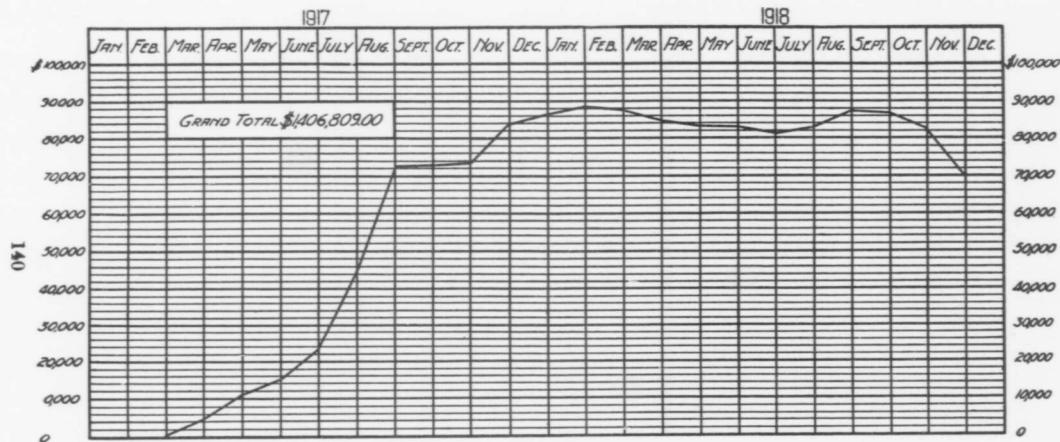
RECORDS AND RECRUITING.

MECHANICS

The first duty of the R.F.C. comprised the securing of a continuous inflow of recruits, both mechanics and cadets, and while it was anticipated that difficulties would be encountered, local conditions as set forth below were such as to make the task unexpectedly arduous. The state of affairs in Canada, so far as concerns mechanics, was briefly as follows:—

- (1) Recruiting for the C.E.F. was practically at a standstill. The country had been "worked out."
- (2) The R.F.C. was practically unknown in Canada.
- (3) High wages were being paid to skilled workers.
- (4) There was no organized recruiting system in use, each Canadian unit doing its own.
- (5) A very large percentage of skilled mechanics were essential for the maintenance of aeroplanes and engines, and these were in great demand at very high wages on munitions.
- (6) The fact that, in a large number of cases, men had to be transported for over 1,000 miles in order to be even interviewed, or medically examined, made recruiting both expensive and difficult.

The brightest point was the lively interest and very hearty coöperation of every officer of the Department of Militia and Defence, and of every officer of the Canadian Forces throughout the Dominion. This coöperation has been maintained throughout our work. Without it no success could have been attained. The spirit of good fellowship and help has been of inestim-



R A F CAN.-ESTIMATED VALUE OF RATIONS DRAWN FROM C.A.S.C.

able value to all our recruiting officers, and later the same spirit, was encountered among the officials administering the Military Service Act, to whose work the operations of another force—engaged in recruiting men otherwise than through the Military Service Act organization, must have been a considerable trial. Instead of objections, the Corps encountered nothing but assistance.

At the end of January, 1917, recruiting offices were opened in Toronto and Hamilton, with a trade test party in each place. The latter was shortly withdrawn as being unproductive, and merged into a central test station at Toronto. Simultaneously, and owing to great distances to be travelled and to difficulties encountered in obtaining suitable accommodation and facilities for trade testing at other centres, it was decided to establish merely recruiting offices at outside stations; and offices were opened at Montreal, Winnipeg and Vancouver, each in charge of an experienced officer trained by ourselves, assisted by a staff of non-commissioned officers and men from England. Oral tests were conducted here, the practical examination being given after arrival in Toronto.

The question of publicity presented a problem, to solve which the following methods were employed:

- (1) Display advertisements in newspapers (large dailies).
- (2) Written items of news and interesting articles.
- (3) Classified advertisements for trades in the various want advertising columns.
- (4) Large posters of striking design used on billboards. These posters were designed by an advertising company.

This work was supplemented by addresses and recruiting meetings.

The cost of (4) was too high to be maintained, and the results of (1) and (2) were so discouraging in the first month that another scheme was evolved. As a result of a conference with the National Board, some 10,000 skilled workers who had volunteered for national service were circularized with attractive literature. From this form of publicity only 860 enlistments were obtained, extending over a period of nearly six months.

On investigation, it was found that the first method of publicity had been so long used by local Canadian Forces that the effect lacked novelty, whereas information conveyed in articles dealing with aviation always brought results. Since display advertisements, however, were a sure means of reaching the public, they were continued, inasmuch as they served to stimulate the interest of the newspaper, and thereby helped in the placing of news items.

The entry of the United States into the war made it possible to endeavour to recruit British subjects across the line. Quarters were secured in New York, and officers visited many of the larger towns, such as Chicago, Boston, Kansas City, St. Louis, Minneapolis, etc., where the British Recruiting Mission had offices, and gave every possible assistance. Occasional visits were paid to these points, except in the case of New York, where an officer was permanently stationed, and from New York came the bulk of the men enlisted in the United States. Altogether about 627 British subjects were thus enrolled.

Owing to the distances between centres and the scattered population, practically all applications for enlistment were dealt with by correspondence, whether from headquarters or out-stations. Transportation had then to be given to bring the applicant probably at least 300 miles for a Medical Board, after which, if successful in passing the oral tests, etc., he was transported to Toronto. This journey, in the case of a man enlisting in Vancouver, occupied four days

and covered 2,500 miles. Sleeping accommodation was provided, also meals en route. None of these difficulties were encountered in England.

The Medical Boards placed at our disposal by the Department of Militia and Defence were accustomed to pass for military service, that is category "A." For the purposes of the R.F.C., as it then was, men of lower category than "A" were quite suitable, as no pack had to be carried and there was little or no route marching. The composition of the brigade is, therefore, very largely of men not fit for active service, and who have been rejected time and time again by the C.E.F. At the outset, Boards absolutely refused to pass for us applicants of a lower medical category than "A," this because the Board was held responsible for any man returned as unfit on arrival in England and *charged* with the cost of his transportation, etc. Further, the British practice of classifying men into "A," "B," "C," "D," and "E" categories was not known. Each assistant director of medical service required to be acquainted with our methods and standards, causing, in consequence, considerable delay.

A further problem was that of pay. Whilst the Corps rate was 15c. higher for skilled labour than the Canadian forces for unskilled, a very high standard could not be set for trade test. The first question of each recruit was: "What is the pay?" "How much will my wife get?" and such answers as the recruiting officer could give were not very reassuring. In contrast with the Canadian overseas man, the prospect was, in truth, hardly attractive. The wife of the latter, owing to the benefactions of the Canadian Patriotic Fund (subscribed unofficially by Canadians) received \$20.00 per month and \$5.00 for each child, in addition to a percentage of her husband's pay. As against this the brigade allowance looked meagre. The relief can be realized, therefore, when, a little later, the authorities of the Patriotic Fund, cognizant of the importance of

R.F.C. work, and that R.F.C. recruits were principally married men, extended their generosity to the brigade as regarding men of category "A," who were eligible for overseas service. Here, too, a tribute must be paid to R.F.C. men outside this category and unable to enjoy this special benefit. It speaks highly for the patriotism of Canadians that these mechanics carried cheerfully on, though under great personal and financial disadvantages.

In the early part of 1918, a number of category "A" men were liberated for the purpose of joining the C.E.F. and proceeded overseas, thus causing considerable shortage of labour in the Corps. Further recruiting appearing impossible, female labour was employed in the capacity of civilian subordinates. It was at first thought that these subordinates would be used only in unskilled trades and office routine, but it was soon evident that they could be trained for simpler and lighter mechanical work. A separate section being formed to handle recruiting and administration, a large number of patriotic women volunteered for duty with the Air Force, of whom 1,200 were selected. Through their work the brigade was tided over a serious shortage of labour. Unaccustomed to aeroplane work, and unacquainted with military routine, they have universally performed sterling service.

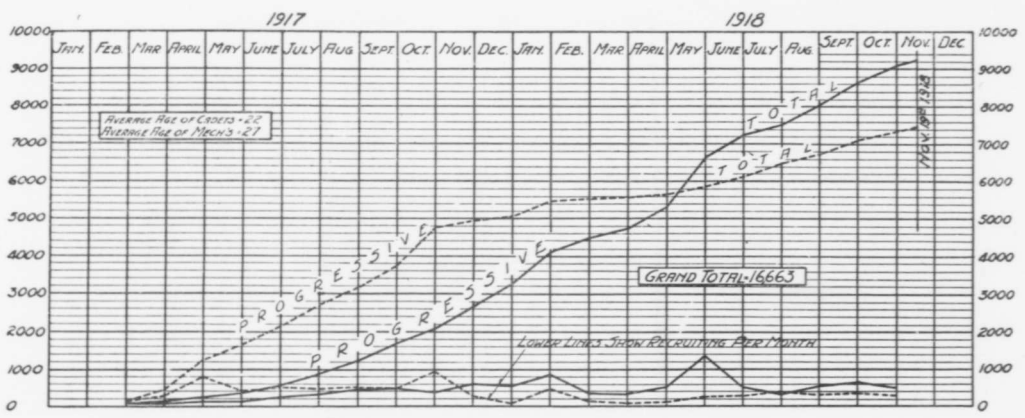
From the very first, civilian female subordinates were employed at headquarters and other units in a clerical capacity. In the autumn of 1918 they might have been seen in any of the shops or camps, dressed in dusters, caps and overalls, taking down engines, grinding valves, stripping aeroplanes and doing all forms of manual labour heretofore always performed by men. At the Repair Parks alone, 135 women were employed at technical trades, while at the various camps nearly 600 were carrying on as mechanics. In the capacity of motor drivers they rendered excellent service. A large proportion of the cars throughout the brigade at the present time are driven by them.

Too much praise cannot be given to the women who have been employed in many varying capacities by the R.A.F. throughout Canada. They have given the greatest satisfaction, and done their work in the most conscientious manner possible. Furthermore, in spite of many predictions, they have caused no trouble whatsoever, and submitted themselves apparently without effort to the necessary discipline of the Force.

The following notes, re female subordinates, may be of interest, showing their distribution:—

In Headquarters Offices and in various cities.	115
Paymaster Department, Victoria St., Toronto.	36
Recruits Depot, Jesse Ketchum, Toronto.....	18
No. 4 S. of A. University.....	90
Cadet Wing, Long Branch.....	9
Armament School, Hamilton.....	14
Aeroplane Repair Park, Toronto.....	134
Engine Repair Park, Toronto.....	65
Stores Depot, Toronto.....	180
Motor Transport Section, Toronto.....	50
Engineer Section, Toronto.....	3
School of Aerial Fighting, Beamsville.....	91
Forty-second Wing, Deseronto.....	230
Forty-third Wing, Leaside.....	161
	1,196

At the time of the signing of the armistice, over 7,000 men had been recruited for the mechanical section of the Royal Air Force, Canada. Nearly fifty per cent. of these were recruited by correspondence, and as many as 15,000 applications were handled through recruiting headquarters and the various out-stations.



RAF. CAN. RECRUITING RECORD OF CADETS AND MECHANICS.

INDEX
 CADETS=====
 MECHS-----

CADETS.

When on May 1st, 1917, the campaign was commenced, the assistance of the Aero Club of Canada was enlisted, and this society used its organization as a recruiting agency.

At the same time, endeavours were made to approach the students of public schools and universities by extensive circularization. It was estimated that about 600 cadet recruits could be handled for training for the balance of 1917, and about 1,500 in 1918, but although thirty-odd schools and colleges were thus approached, the scheme was unproductive of results. It was decided, therefore, to try out more thoroughly the idea of civilian recruiting committees, and bodies composed of about three influential, public men were organized in the following cities:—

Toronto, Ontario.
Montreal, Quebec.
Charlottetown, P. E. I.
Winnipeg, Manitoba.
Regina, Saskatchewan.
Calgary, Alberta.
Vancouver, British Columbia.

These committees, being furnished with our medical standards, were empowered to interview applicants, have them examined by the local Medical Board and apply for transportation to Toronto for final test and approval. It will be understood that the committees were not active recruiting agents. They simply passed opinion on the men sent to them by the wing, all applications being made through headquarters. The Royal Flying Corps was by this time becoming known and talked about throughout Canada. Publicity was better managed, and there were received on an average

twenty applications per day from the whole of Canada. Uneasiness was felt about this time as to an adequate supply of cadets being available. The demand was continually increasing. Towards the summer of 1917 it reached 300 per month. A little later in the fall it rose to 400 and 500 a month, requiring in two months what in April, 1917, had been estimated as the need for two-thirds of the whole year.

A new plan was therefore necessary. Statistical research indicated that past efforts had not reached the public except in large centres. It was, in consequence, determined to enlarge the civilian committee plan, and establish committees in every town of 10,000 inhabitants and over, throughout the whole of Canada. In places of less than 10,000, the assistance of at least one important man was sought to accomplish this, and the Dominion was completely divided into five recruiting districts with headquarters offices at Vancouver, Winnipeg, Toronto, Montreal and Halifax. Each district was supplied with an officer in charge, and a second officer, whose duty it was to travel continually from place to place establishing committees and advise and assist those committees already established. The scheme proved very successful. About 350 civilian committees, with a total of over 1,000 members, were established throughout Canada, and the travelling officers, by the mere fact of their presence in the different towns, stimulated interest, and through interviews with local papers obtained publicity. Coincident with this, the matter of publicity was tackled in a serious way by a campaign whereby it was hoped to bring to the notice of every man in Canada the work being done by, or at least the name of, the Royal Air Force.

About this time the Military Service Act commenced to operate and there seemed a danger of all the available material being absorbed into C.E.F. units. A reserve class "B" was therefore started, and the surplus cadets were placed on this reserve.

From this time on, committees coöperating more fully, the number of applicants steadily increased and there has been no difficulty since then in supplying the demand for cadets.

The difficulties encountered in cadet recruiting were:—

- (1) The task of informing the public that cadets would be taken for training as pilots. Not only had the fact to be known that men were wanted, but it was also necessary to say exactly what a pilot had to do. There still seems to be an impression that it is very difficult to gain admittance as a pilot.
- (2) Before the Royal Flying Corps, Canada, was formed, pilots were trained at a civilian school. They paid about \$400 for the course, and then had to take a chance of being accepted in England. The general public required to be acquainted with the fact that training was *free* at an Army School.
- (3) It was absolutely impossible to interview all the applicants at headquarters or at brigade centres, or to deal with them by correspondence. The committees formed were, therefore, given this work, and as soon as they thoroughly realized the requirements, they rendered the very greatest service, and have been, as pointed out, the backbone of cadet recruiting.
- (4) The medical examination of cadets presented almost similar difficulties to that of mechanics. Brigade standards were entirely different from those usually adopted by the local boards. It was very difficult to secure an examination which was anything more than superficial.

The Barany revolving chair is now employed, and in doubtful cases trial flights involving specified

tests are given. In this way it has been possible to accept some borderline cases, where under the old system rejections would have been inevitable.

- (5) It should not be forgotten that in this, as well as in the campaign for recruits, the same staff was employed.

The brigade was handicapped from the commencement by the absolutely inadequate staff provided. It has only been by most strenuous efforts in training officers and men in the work that it was carried on at all.

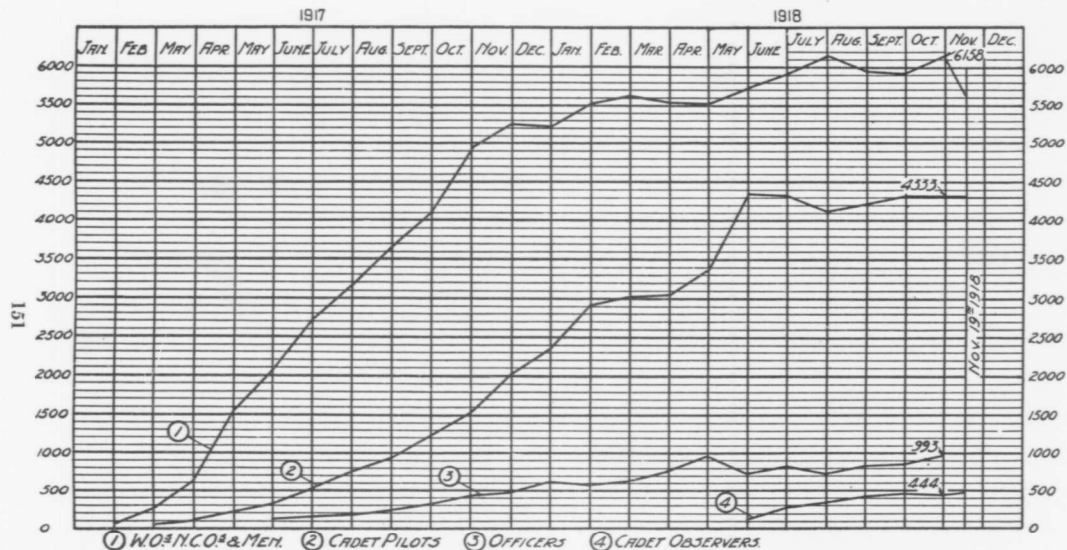
At the time of the signing of the armistice, 9,200 cadets had been enlisted for service, while 35,000 applications had been handled by headquarters and the various outstations.

RECORDS AND PERSONNEL SUPPLY

Unusually complete records of cadets and airmen enlisted were kept from the very commencement of work in Canada. Where documents were sent to officer in charge Records and the War Office, duplicates were always kept. For this reason no change in organization or administration was necessary when in September, 1917, the General Officer Commanding was appointed officer in charge Records for Canada.

The continuous growth of the Air Force in Canada has meant a corresponding growth in records. From time to time demands outgrew systems, and it became necessary to remodel, so as to conform to Imperial administration and yet dovetail with existing regulations and conditions in Canada.

All posting of mechanics and of cadets throughout their training has been carried out by this unit. The records of the training of mechanics, and their progressive history from station to station, have been



RAF. CAN.-MONTHLY STRENGTH OF OFFICERS, W.O. N.C.O.s & MEN, CADET PILOTS, CADET OBSERVERS.

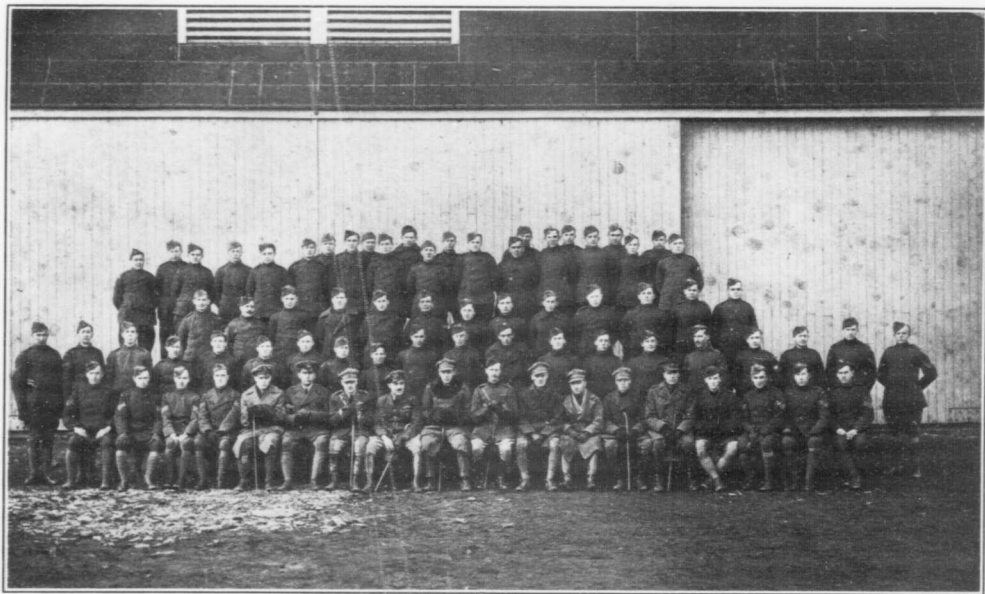
maintained by the individual card system. A complete history of each cadet from the time he first made application until the time he proceeded overseas, through every stage of training and every movement, has been kept in minute detail.

New departments required organization to deal with pensions and other subjects on which there was very little information available; while the work of handling other sections, such as discharges, was continually on the increase.

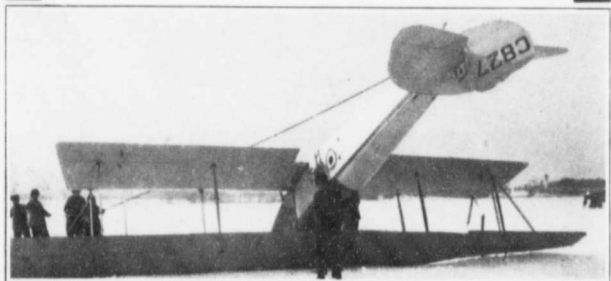
In many cases the forms called for by K. R. were not available, new forms being printed locally, also those used by the Medical Services, which, although provided by the Canadian Militia, were often not applicable to Imperial requirements.

It is found, however, on demobilization, that the records are in excellent shape, and that the information at the disposal of this office is complete.

Space does not permit of the printing of the hundreds of individual names making up the personnel of those committees in various towns to which the Corps is so greatly indebted, but to each and all, the General Officer Commanding tenders in the name of the Royal Air Force, his most sincere and hearty thanks for work, without which such progress as may be credited to the brigade could not have been achieved.



89TH SQUADRON—CAMP MOHAWK.



RIGHTING A MACHINE.

THE CADET WING.

The Cadet Wing, like its younger and larger brother the School of Aeronautics, found shelter at its birth in buildings most kindly loaned by the University of Toronto. This was at the beginning of March, 1917.

Prior to this, all R.F.C. cadets recruited had been equipped, accommodated and generally looked after at Victoria College by the Canadian Officers Training Corps, of the University of Toronto. This unit, together with the School of Infantry of the District, continued for some weeks to ration the cadets, but during hours of parade they came under the Cadet Wing for instruction.

Already there were in existence the Recruits Depot, Stores Depot and "X" Squadron at Long Branch. Up to now there had been no tuition prior to flying, except such as could be given by the much overworked but extremely efficient 2nd Lt. in command at Long Branch.

The strength of the Cadet Wing was, to commence with, some 50 cadets, taken care of in ground instruction by 2 officers, 3 non-commissioned officer instructors and some two or three clerks. Lectures covered artillery observation, organization of troops, military law and such technicalities as rigging, engines, etc. It will, therefore, be seen that the two officers in charge were required to call upon the sum total of their knowledge and experience to discharge their official duties. The wing was fed direct by the recruiting office, since cadets did not at first pass through Recruits Depot.

Gunnery instruction was added shortly, though the wing was woefully deficient in suitable material. Simultaneously courses were organized, and a regular

programme set on foot. Through the courtesy of the O.C. School of Musketry Military District No. 2, arrangements were made by which all cadets took a course in machine gunnery at Hart House, including range practice. A Curtiss machine was secured (a peculiarly massive aeroplane, discarded as impractical by the Curtiss Company), and though no mechanical power would have lifted it into the air, its bones served to illustrate the anatomy of the structure of which it was a prototype. There was also one Curtiss and one motor car engine. It will be noted that by now the wing had assumed the threefold function of a Cadet Wing proper, a School of Aeronautics and an Armament School.

As can be understood, the course was not of any set length. The passage of a cadet through the organization depended upon his capacity to learn, and the requirements of the flying units. The first graduates proceeded to Long Branch where, equipped with such tuition as time had afforded, they began flying at once. By the end of April, drafts were sent to Borden, where further ground instruction was now being given.

Further expansion came in May, and with it additional help from the University authorities. The splendid buildings of Burwash Hall were secured from Victoria College, and the commodious East Residence rented from the University of Toronto. It is difficult to say what would have been the progress of this work of the Corps, were it not for the constant consideration received from the President, Governors and Superintendent of the University.

With expansion, arrived also the need for some subdivision of duties. The Cadet Wing was too polyglot. It provided as much as humanly possible of everything, but not enough of anything. Came therefore the first demarcation between the Cadet Wing and the School of Military Aeronautics,—i.e.



OFFICERS AND STRENGTH, 43RD WING, LEASIDE.



RECEIVING WIRELESS ✓



ARTILLERY OBSERVATION. ✓

the junior and senior sections, though for official purposes of administration they were still unified. New instructional equipment arrived, and during May the strength of cadets rose to nearly 150.

Before passing on to later history, it is desired to give sincere and official recognition to the splendid work done at this early stage in spite of meagre facilities and an absurdly small staff. The difficulties encountered were many and serious. The wing was still in the throes of active service organization, but all eyes were turned to the output of cadets as the crux of the situation, and the means by which officers and men alike were to justify the programme then being worked out. The output has never failed, but at no period did it involve greater personal strain and effort than in these first two or three months of this unit's existence.

On June the 11th, a staff of nine officers and thirty-eight men arrived from England to form officially the School of Aeronautics, and took over general instruction at the Cadet Wing prior to the final subdivision of the latter. This occurred on July 14th when the wing moved out to summer quarters at Long Branch which was then given up by "Y" Squadron as an aerodrome. Work continued with constantly increasing numbers, till the winter of 1917, when, on the departure of the 42nd and 43rd Wings for Texas, the unit divided itself between Borden and Mohawk for some six months. Here instruction continued without interruption till April 4th, 1918, on which date the two sections reamalgamated at Long Branch, with a strength that now reached a staff of 200 officers and men and 900 cadets.

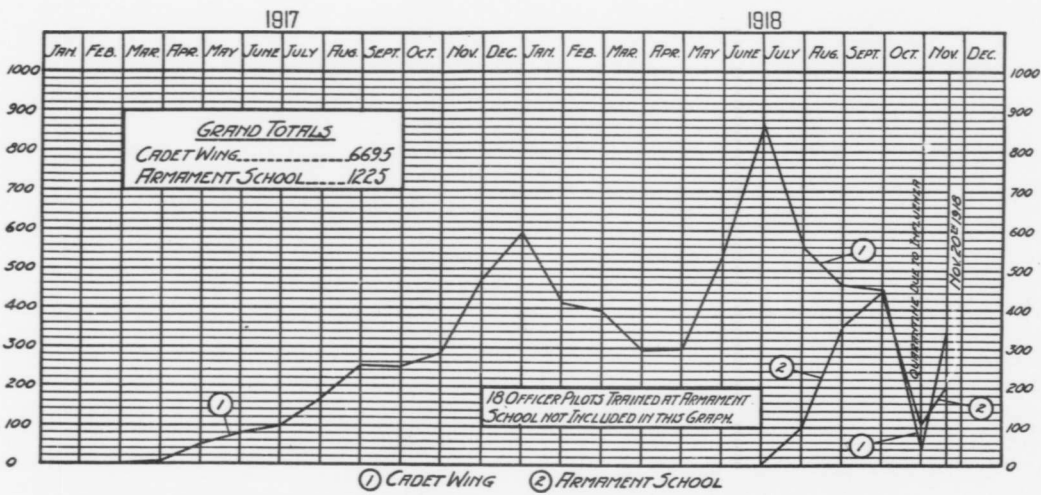
The formation of the Armament School in the early summer permitted the wing to cease elementary gunnery instruction and devote more time to drill, discipline and wireless, but it should be remembered that the Armament School was the logical expansion

of work previously carried out at the Cadet Wing and School of Aeronautics.

In the summer of 1918, the wing was on the lines of an infantry battalion, with four squadrons and a headquarters company. Drill, physical training, wireless, topography and air force law were in the curriculum, but the essential and psychological duty of this unit was to impress on the new recruit those fundamental precepts of military discipline, honour and self respect on which his future career alone could be successfully based.

As to relaxation there was begun on July 18th an excellent monthly magazine, "The Cadet Wing Review," which is second to none of similar publications. Local talent also conducted a theatre which was a veritable centre of attraction.

Through this summer, the average strength was 200 staff, and 1,100 cadets. To house them for the winter, large barracks had just been completed at the close of hostilities. The output of cadets of the unit will be noted by the graph on page 161.



R.A.F. CAN.-OUTPUT OF CADET WING AND ARMAMENT SCHOOL

SCHOOL OF AERONAUTICS.

By May 1917, it had become quite apparent that ground training of cadets demanded an expansion of treatment which could not be afforded by the then existing Cadet Wing, however, valiantly the latter unit might strive, and on the 15th a chief instructor, for the purpose of starting a School of Military Aeronautics, was ordered to proceed to Canada, taking with him eight other officers and thirty-eight men of various ranks as a nucleus of an instructional staff.

This advance party worked in conjunction with the Cadet Wing until July 1st, on which date No. 4 School of Military Aeronautics was recorded as a separate and official organization.

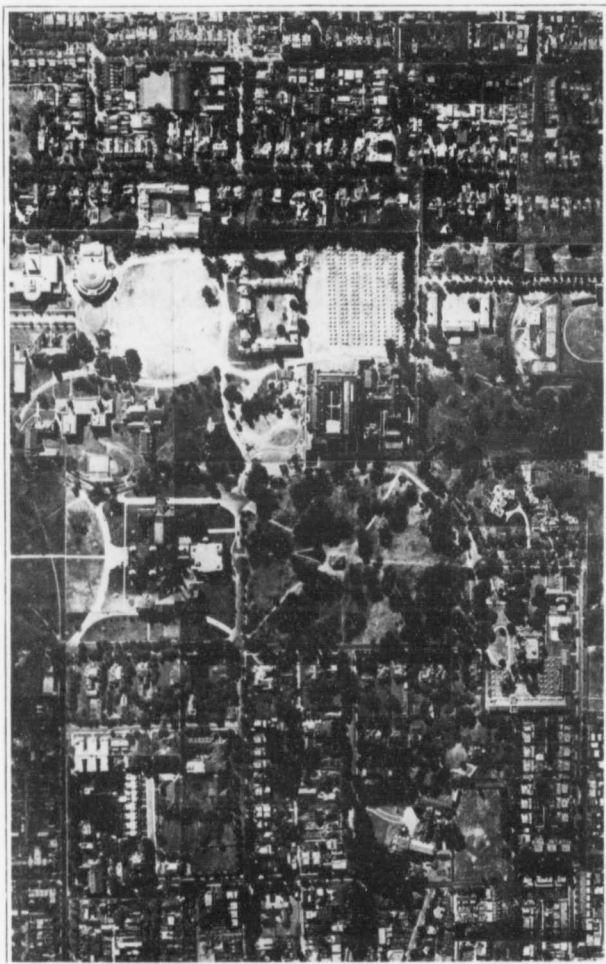
The anticipated expansion immediately took place, aided very greatly by the assistance, not only of the President of the University of Toronto, but also of the professors of that institution who gave up room after room, often at great inconvenience to themselves. About this time, also, a large shipment of aeroplanes and engines for instructional purposes was forwarded from England. It was unfortunately lost on the way out, the immediate effect being that for the first few months all practical instruction was confined to the Curtiss engine and JN4 aeroplane.

The length of the course given during this period was three weeks, but at the end of the month it was increased to four, and comprised six flights, covering engines, rigging, wireless, artillery observation, machine guns, and instruments and bombs.

The importance of the work done at this unit was now most firmly established. The length of the course was increased in September to six weeks, and it was arranged that three courses went through the school at a time, each composed of 150 cadets with two weeks



STAFF OF SCHOOL OF AERONAUTICS.



"AERIAL" OF VICINITY OF UNIVERSITY OF TORONTO.
(Note the Cadet Camp lying north of main University Building).

intervening. By now the strength of the unit had increased to 19 officers, 119 non-commissioned officers and men, 149 United States army and naval cadets and 261 Imperial cadets. Occupation of the buildings so kindly furnished by the University authorities covered Burwash Hall, East and South residences, School of Practical Science, Medical Building, portion of Convocation Hall, Thermodynamics Building and dining halls in University and Victoria College.

In September, instruction was further expanded by the formation of a school at the factory of the Canadian Aeroplanes Limited, where members of flying units received introduction to the theory and principle of aeroplane construction. There were three courses, each lasting eighteen days, and each being divided into ten squads, members of which remained together throughout their entire period of instruction. Examinations were set and corrected by an examining party at the School under direct supervision of the Commandant, when sixty-five per cent. of marks was necessary before a cadet passed through and was posted to a flying unit.

In the month of December, 1917, the strength of cadets greatly increased and it became necessary to draw again on the goodwill of the University authorities and occupy Wycliffe College. Simultaneously a pool was formed in a remodeled hotel, Haydon House, some four miles from the School, where were housed such cadets as the flying units were unable to take owing to the reduced amount of flying during the winter months. By the end of the year cadets on the strength amounted to 721.

Training material now began to arrive more regularly from England, and, as a result, the instruction given was considerably diversified.

In March, 1918, a seventh flight was formed for the study of aerial navigation, in which much more complete instruction was given in map reading and

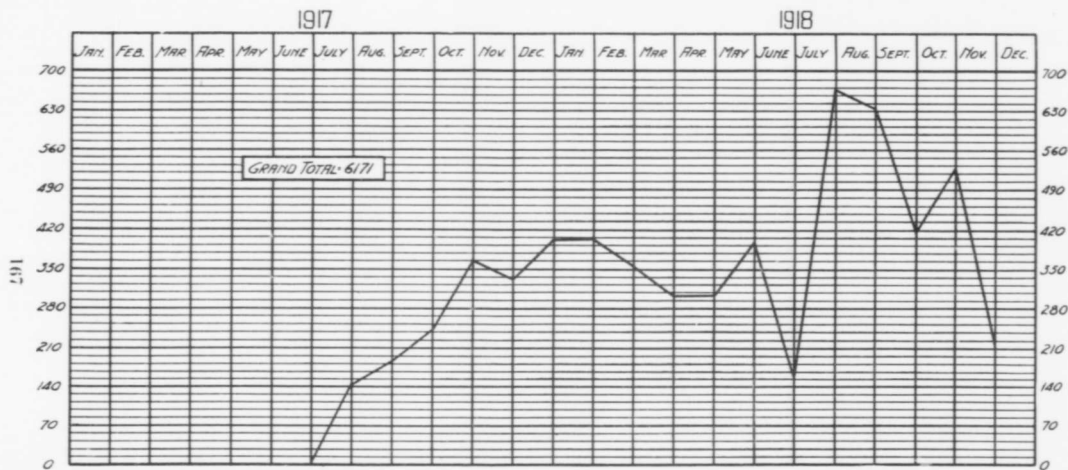
course plotting. Machine gun instruction was transferred to the Armament School at Hamilton, and the time thus secured given to further study of aerial navigation.

The practical education of the mechanics taught at the School was ensured by the construction at Leaside of engine running sheds, in which engines of various types were set up and their operations drilled into all pupils under conditions which simulated those on active service as nearly as possible. Considerable improvement in the engine knowledge of cadets was immediately noticeable.

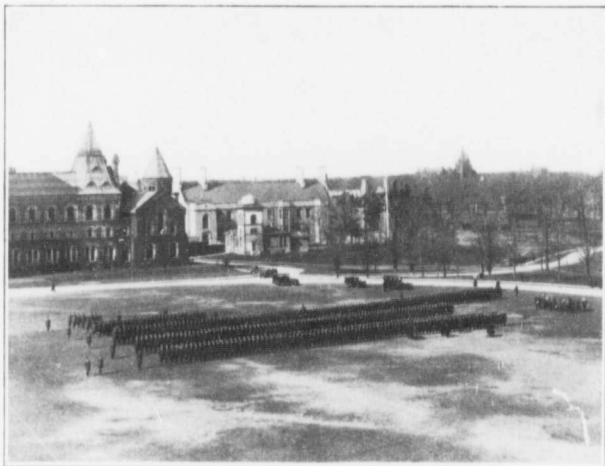
On April 1st, cadets in training at the School, now called No. 4 School of Aeronautics, had reached 1,277, while the staff was composed of 26 officers and 230 non-commissioned officers and men, with the inevitable result that another residence was taken over from the University, with housing capacity for 185.

Again a flight was added to the course, this time for observers, and by July all cadets thus passing through the unit received instruction in aerial navigation, instruments, reconnaissance, organization of the Army and R.A.F., and general military knowledge, photography, engines, rigging and wireless.

In September, the process of engine instruction was still further advanced by discarding the fixed stands to which Curtiss engines had been rigidly attached, and substituting in their stead sections of aeroplane fuselages so balanced as to be capable of vertical adjustment, thus simulating the action of machines when in the air. To these were attached Clerget engines, which it was now proposed to use in conjunction with the Avro machines contemplated for flying instruction. This departure from the reciprocating to the rotary type made it necessary to organize special classes of tuition for non-commissioned officers and men from various flying units. In this course, the assistance



RAF. CAN. - SCHOOL OF AERONAUTICS OUTPUT OF PUPILS



PARADE ON UNIVERSITY CAMPUS.



CADET CAMP, UNIVERSITY LAWN.
(Note "Aerial" of this Camp on page 164.)

given by the School Board of Toronto by the use of a portion of the Lippincott Technical School proved greatly to the advantage of the brigade.

The only further change made in the system of instruction at the School of Aeronautics, was the introduction of the block system in October, 1918, under which forty hours were allotted to engines, twenty-seven to aerial navigation, twenty to wireless, twenty-six to rigging and thirty to artillery observation. The observers' flight was carried on independently of the above, and the ninety hours' instruction given to the latter on technical subjects covered all requirements.

In concluding this very brief sketch of an extremely important section of the brigade, it is desired to specially acknowledge the services of not only the instructing officers but also of the non-commissioned officers and men on the staff. It fell to the duty of many sergeants and corporals to demonstrate the principles and theories of highly technical appliances, and to demonstrate them moreover in many cases to men who were much their seniors and who had had the advantage of a modern and expensive education. It was, however, uniformly observed that the non-commissioned officers who occupied this highly responsible and difficult position, discharged their duty not only with a dignity beyond all praise, but also with an exemplary clearness based on an intimate knowledge of the subject. They were confronted very often with questions which would have confused many who laid definite claim to higher attainments, but it has not yet been found that any one of them was lacking either in the technical qualification or the power of self expression which was necessary for the satisfactory discharge of their duties. The marked improvement in the all-round ability of cadets arriving at the various flying wings after the School of Aeronautics had had time to finally find itself, is due to the excellent work done by officers and non-commissioned officers alike at this unit.

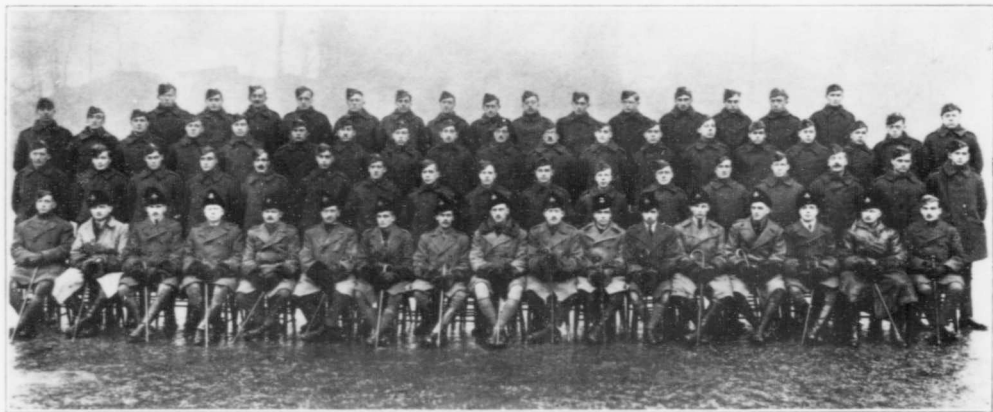
ARMAMENT SCHOOL.

It is a far cry from the one-time pilot who, between the vagaries of his machine, took pot shots at his opponent with a revolver or sporting rifle, to his successor of to-day armed with a machine gun that discharges bullets at the rate of 600 per minute through a four-bladed propeller revolving at the rate of 1,200 times a minute. It was, therefore, the object of instruction at the Armament School to so train the would-be pilot that he might have a thoroughly grounded knowledge of the weapons he was destined to use. The need of special tuition there given was further accentuated by the increasing pressure on the instructors at the School of Aeronautics.

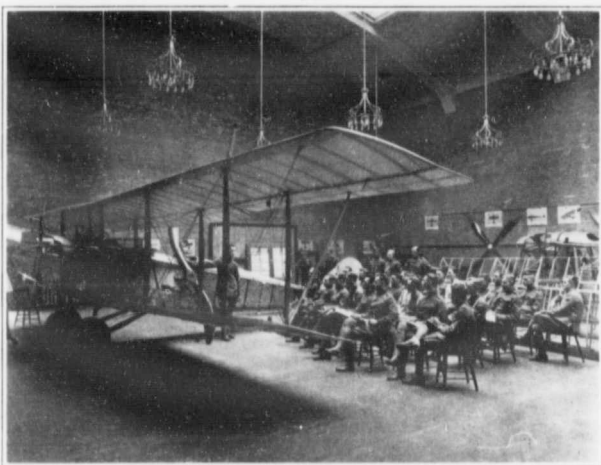
In March, 1918, the O.C. proposed to the War Office that this School be set on foot immediately, and matters had been so far advanced by May that necessary construction was well under way. Here again the R.A.F., Canada, was fortunate in being the recipient of much consideration from Canadian organizations. On learning that accommodation was required for the purposes of the School, the Canadian Westinghouse Company Limited, one of the most important industrial concerns in Canada, most generously offered the use of a large factory in Hamilton free of charge, together with adjacent grounds, and shortly afterwards the brigade was further helped by permission to use the area of a 9-hole golf course immediately adjoining. This very considerate proposal was made by the Hamilton Golf Club, and was gratefully accepted.

These preliminaries successfully arranged, the matter began to move rapidly.

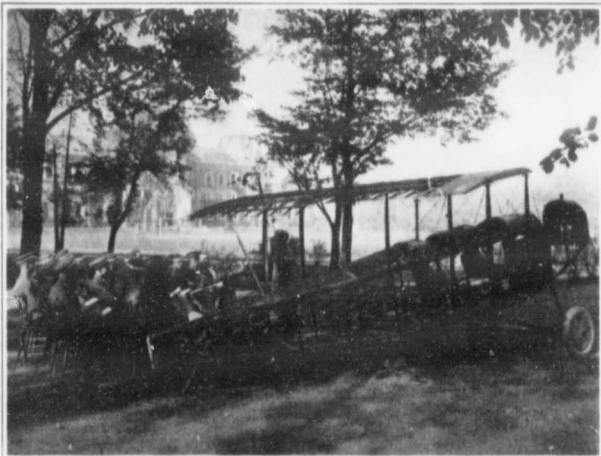
In May three officers and two non-commissioned officers left England to form the nucleus of the



OFFICERS AND STAFF, ARMAMENT SCHOOL, HAMILTON



RIGGING FLIGHT, SCHOOL OF AERONAUTICS.



AEROPLANE DESIGN, SCHOOL OF AERONAUTICS.

instructional staff, bringing with them such material as could be provided at the moment. The Aviation Department of the Imperial Munitions Board assumed responsibility for the physical portion of the work in hand, under the supervision of the Royal Engineers section of the brigade. This provision included ranges, armouries, workshops, instructional and lecture buildings, a hospital, and the general adaptation of the interior of the factory buildings to the purposes required.

All this advanced so swiftly that by June 19th, the factory building was equipped, and the Armament School, which up to this time had formed a portion of the Cadet Wing at Long Branch, moved to its new quarters on June 20th.

The course of instruction called for a much further excursion into applied mechanics than any portion of the tuition formerly given. As it progressed, it soon became evident that the embryonic pilot was keen for intimate knowledge of the guns on the efficiency of which his future victories depended, and his general course was so modulated as to give him the opportunity to master the last detail. The question of a method of sighting which would allow a deflected aim to be laid on a moving machine received mathematical attention, as was also the synchronizing of a gun with the revolving blades of the propeller. On this and other points, information was continually being received and communicated through the School to other units of the brigade.

Drafts of cadets, arriving on Wednesday afternoons, were immediately handed over to the quartermaster's department, where arrangements for their domestic comfort were made for the four or five weeks they were to remain. The following morning instruction began, first with one gun, its description, action, care and possible troubles in the air, accompanied by range work and constant handling. The question of aiming was gradually introduced and ran progres-

sively throughout the course, until the pupil felt that he could, without effort, fire the gun in the air, making allowances for his own speed and direction, his enemy's speed, direction and range, and instantaneously adapt his fire to meet the ever-varying and never-ending manoeuvres of his own and his enemy's machine.

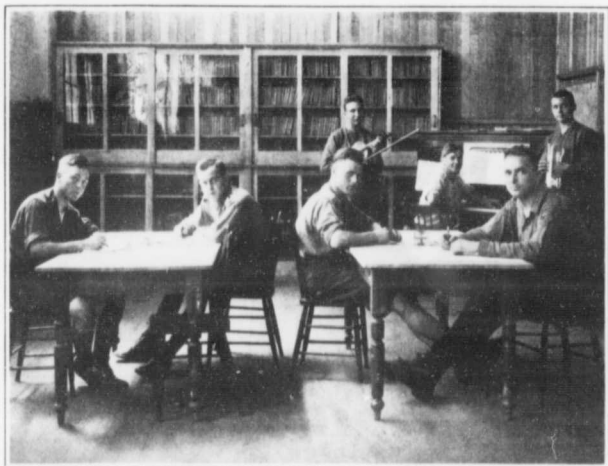
Both guns and sights having been mastered, the cadet was introduced to the subject of gearing his gun to fire through his propeller at varying rates of revolutions. The principle upon which this gearing depended, though one of great difficulty in instruction, was nevertheless the subject which, of all others, provoked the greatest interest amongst the pupils.

Arrangements were completed to enable the pilot actually to carry out the process of synchronizing his gears and propeller under conditions which perfectly simulated his position in a machine. He was thus enabled to watch the principle at work.

Instruction being completed in two guns, ammunition, aerial bomb sights and synchronizing gears, another section of the School undertook the pupils' training in bombs, bomb dropping and bomb sights.

The increasing importance of this subject was appropriately balanced by the very wide range of sights and bomb-dropping apparatus demonstrated by specially experienced instructors, whereby the pupil was made cognizant of all the operations of loading bombs on machines, fusing them, attaching the necessary releasing gear, and so loading his machine that he could at will drop any type of bomb suited to any target which might suddenly present itself, from a group of infantry which needed scattering, to the ammunition dump to be exploded.

The peculiar path taken by a bomb in falling from a machine with a forward momentum imparted by the speed of the machine, needed very special mathematical calculation to enable the pilot to release it at a con-



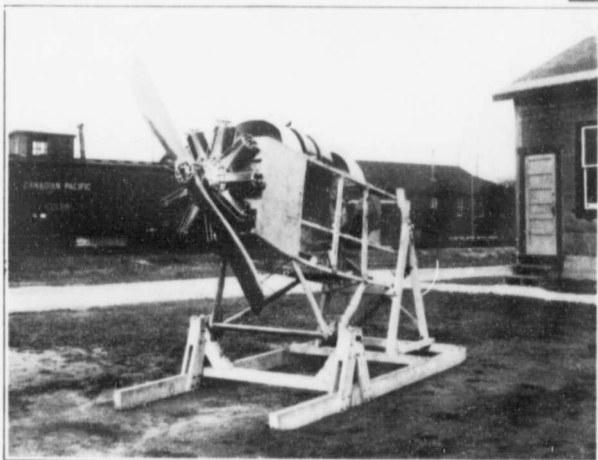
LIBRARY, ARMAMENT SCHOOL, HAMILTON.



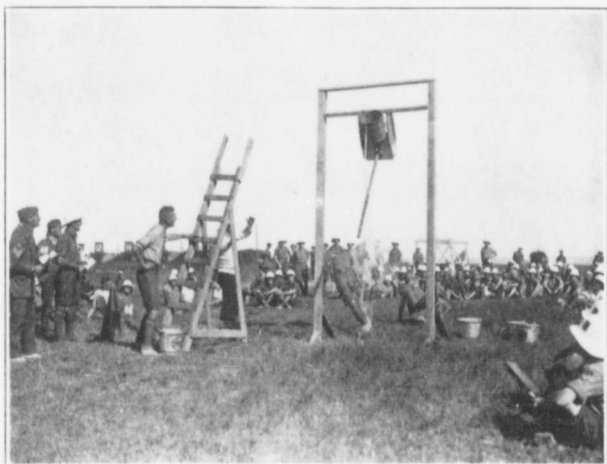
CADET BARRACKS, ARMAMENT SCHOOL, HAMILTON.



ENGINE FLIGHT. ✓



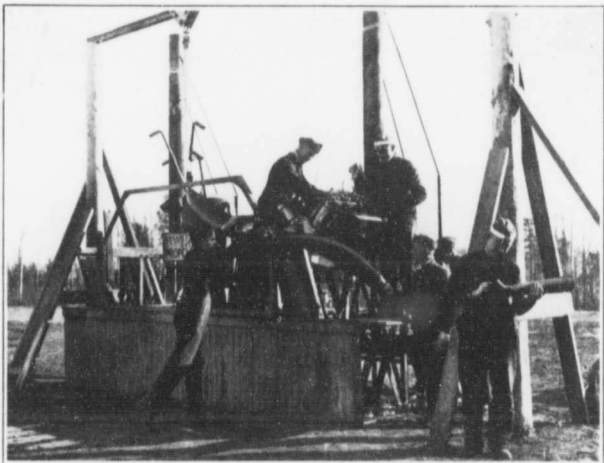
CLERGET ENGINE ON ROCKING NACELLE.



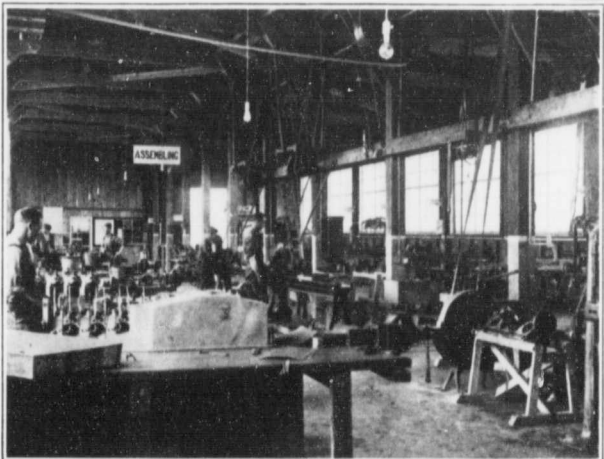
TILTING.



CADET SPORTS.



ENGINE TEST, CAMP BORDEN.



ENGINE REPAIR, CAMP BORDEN.

siderable distance from his objective, and to this end a variety of bomb sights were explained and practised with from dummy machines with unfused bombs over mechanically moving scenery.

The flying camps, to which cadets were posted on the completion of their course in elementary gunnery, carried on further practices in coöperation with this school, and instructors were sent to these wings from time to time to coöperate, and to insure that no gaps or overlaps occurred in the cadet's training. By this means the pilot who left this country for overseas was assured that he had covered every section of the field of armament, and that no situation was likely to occur during his flying career with which he could not deal.

In addition to the training of embryo pilots, courses of instruction were conducted for observers, during which, for a period of three weeks, they were made competent to handle the gun which they would be required to use overseas. By the use of guns with camera attachment, recording a photograph on a graduated screen instead of firing a shot, the resultant photograph revealed to the observer the effect of his shoot, and his graduation was not considered complete until he was able to produce a collection of photographs which evidenced an automatic and deadly aim.

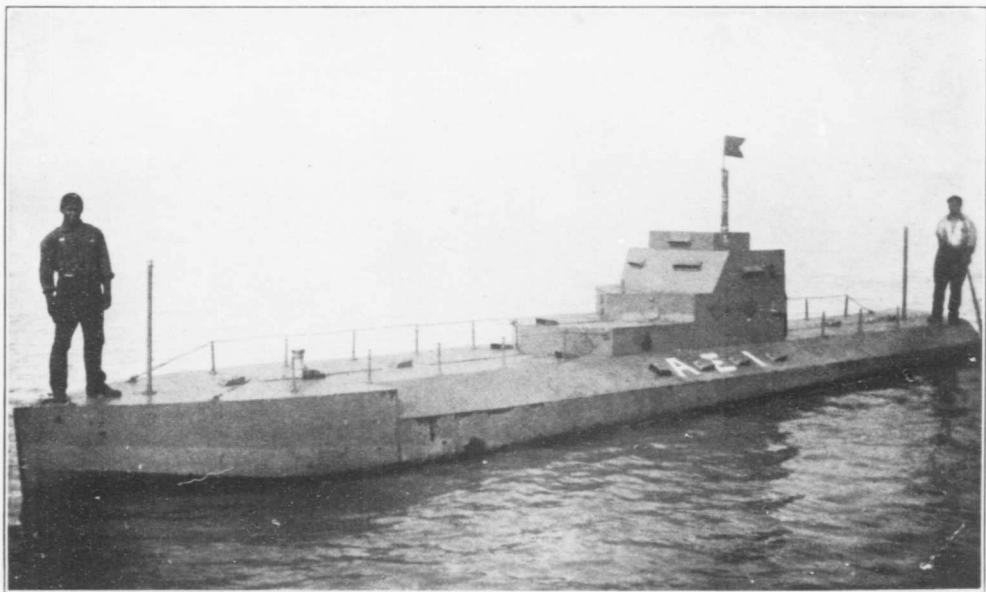
During the period in which this School operated, an average of more than 400 cadets per month was instructed, and the record which each carried overseas showed a complete and thorough course of ground training performed entirely under Canadian tuition.

AERIAL GUNNERY.

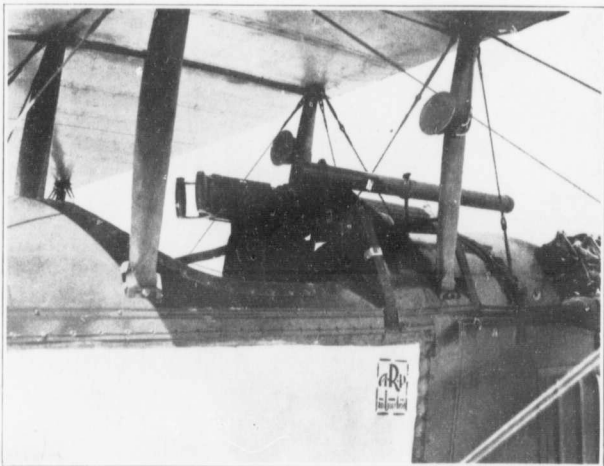
For the first few months, the Corps had an all sufficiency of work in organizing depots, selecting aerodromes, arranging for recruiting, and numberless other activities on all of which largely depended whatever future success might be achieved. There was no aerial gunnery for the reason that there were no instructors. What had been done on the ground was elementary, and reasonably so, due to the lack of material. Matters moved forward when the first instructors arrived in Canada on April 25th, 1917, and, having formed a class of picked mechanics (the instructors of the future), enabled the School of Aerial Gunnery to be organized at Camp Borden on May 1st.

The School had just two guns and 18 pupils—the historic “eighteen” who formed the first shipment of real pilots. The latter had no aerial work—the overseas call was too imperative—but each fired 40 rounds at a ground target.

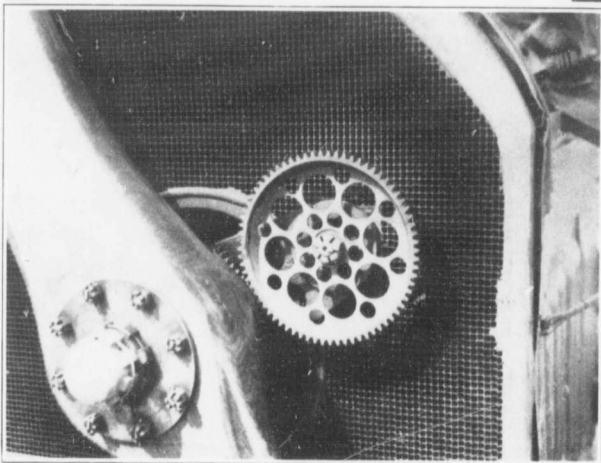
Meantime the School of Aeronautics was busy, and the effect became noticeable. Camp Borden, relieved of much elementary training, did higher and aerial work, and got for itself ranges, fixed targets and silhouettes. The course lengthened to three weeks with 100 rounds fired in the air from a Lewis gun—no aerial Vickers being available. In July came more guns and equipment from England, the second course began with 62 cadets and the state of affairs definitely improved. Camera guns turned up, and became instantly popular. Work commenced on fitting a timing gear so that the gun might shoot through the propeller. The chief disadvantage was the shortage of serviceable machines available.



ARMoured LAUNCH FOR GUNNERY PRACTICE.



SYNCHRONIZED VICKERS' GUN. ✓



SYNCHRONIZING GEAR. ✓

In August began the third course with sixty-six cadets and an organization fairly complete, being forty officers and ten N.C.O. instructors. Now, too a JN4 machine was converted to a JN4A with the pilot in front and a Scarff mounting behind for the observer, as in the Bristol fighter. A decided acquisition this, and a quantity were ordered. Surprise deflection shooting was introduced. It was a busy and interesting period.

The fourth course in September had 124 cadets. The tuition given was of proved value. Lectures came in by the fighting instructor, and naturally increased the pupils' confidence. The latter were now firing 750 rounds from the ground and 150 from the air, and the squadron worked at high pressure to give each pupil three hours' aerial gunnery flying—a matter of difficulty owing to the scarcity of machines with synchronized guns. It was probably due to this that cadets were getting too much Lewis gun observers' work. The fault was rectified, though the mountings were not entirely satisfactory.

The fifth course began in October with a total of 238 pupils, who proceeded with the unit to Texas and enjoyed excellent facilities which had been foreseen and provided. The number of available machines increased, and were divided into C.C. gear (synchronized gear) camera gun and turret machine flights. Actual aerial instruction was given twenty-four hours after arrival at this far Southern field.

The history of Royal Flying Corps gunnery in Texas is a progressive document, too lengthy to give in detail. Here the unit had its first target practice over water—Lake Worth proving ideal for the purpose, and instruction was greatly aided owing to a better observation of fire and a clearer angle of approach. In December the pupils turned out numbered 264, an average flying time of practically five hours—a marked improvement.

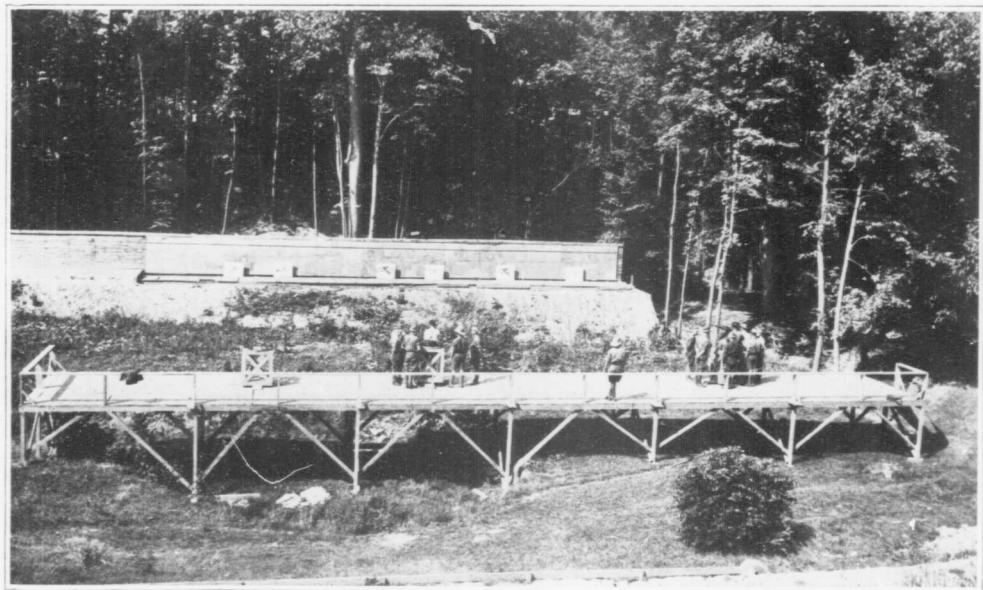
In January the aerial work of the School was further increased. Range work (25 yards) was taken over by the wings. All synchronized guns were moved from the side of the cowling to the top, thus creating active service conditions. No. 2 squadron came into being with twelve machines, giving 30 in toto, the work being done by flights. Two machines were converted to Canadian Gothas, with the gun firing through the bottom of the fuselage. The output of pupils increased to 310, with average flying time of 5½ hours.

February saw the use of a good armour-plated disappearing and running target, and cadets also fired from a cage that travelled along a cableway between two towers, but the speed was too low to be of value. The February output was 313 pupils. The instructing personnel had now increased to 60 officers (50 flying), 1 warrant officer, 60 N.C.O.'s and 250 men.

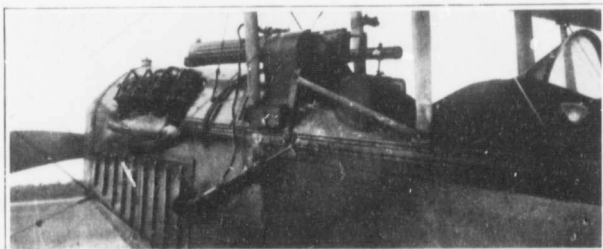
March, a busy month, with 336 pupils and flying time average of 6½ hours, was a record in output and time flown.

April saw the School on its own aerodrome at Beamsville, Ontario, where facilities were ahead of anything heretofore existing. Came as well a third squadron. The output was 243 pupils, all R.F.C. with 7 hours and 40 minutes flying, the record time to date.

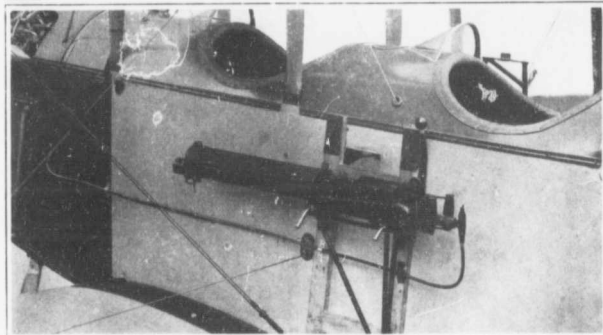
In the following month the syllabus was amended, this being the result of a visit to England by the officer in charge of Canadian training. All straight target shooting was abolished, and deflection sights were introduced so as to allow for a speed of 100 m.p.h. of an enemy machine. Small model aeroplanes were built and set up beside the targets. At these the pupil aimed, the deflection of the gun sights bringing his shots on to the target where their accuracy was of course registered. No less than 17 various practices were laid down. The improvement in ground work soon became noticeable.



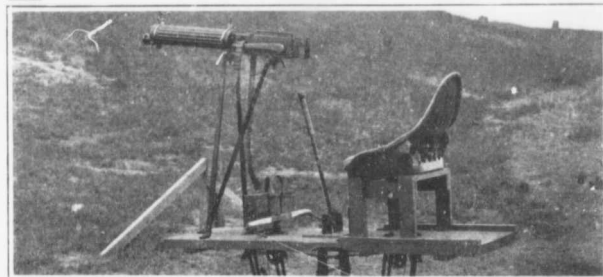
RANGE CONSTRUCTED BY AVIATION DEPARTMENT AT BEAMSVILLE ✓



SHOOTING THROUGH PROPELLER. ✓



BESIDE THE FUSELAGE. ✓



VARIOUS GUN MOUNTINGS. ✓
GROUND PRACTICE.

In May, also, the Armament School opened at Hamilton, and relieved the School of Aerial Gunnery of giving elementary instruction after pupils had already learned to fly.

During June a fourth squadron was added to train observers exclusively, enabling the School to adopt the ideal principle of giving all pilot cadets synchronized gear and camera gun training, and all observer cadets instruction in Lewis and turret camera guns, the sequence being as follows:—

1. 1 hour dual camera gun—12 pictures of silhouette taken by diving on it from behind.
2. 1 hour dual, with pictures of a target machine in the air, allowing for speed of 100 m.p.h. and necessary deflection.
3. Dual, on C.C. gear (instructor in back seat) diving at angle of 60° to 45° at silhouettes in Lake Ontario, 200 rounds or one hour.
4. Dual, 1 hour or at least 60 rounds with gun stoppages. This determines the pupil's proficiency in clearing jams.
5. Dual, enfiling with C.C. gear, 200 rounds diving from 1,000 to 100 feet at dummy trench in Lake Ontario.

During all firing over the water, observations are taken from a watch tower, and a complete report of all results is compiled.

There follows then another 4 hours' dual, after which the pupil goes solo and repeats all he has previously done under the watchful eye of his instructor.

Arriving at the final instructional squadron, there ensues an ultimate 4 hours' dual work before the nearly graduated pilot is asked to do one spiral, two vertical banks, three loops, four Immelmann turns, five half-rolls and six complete rolls. During all this

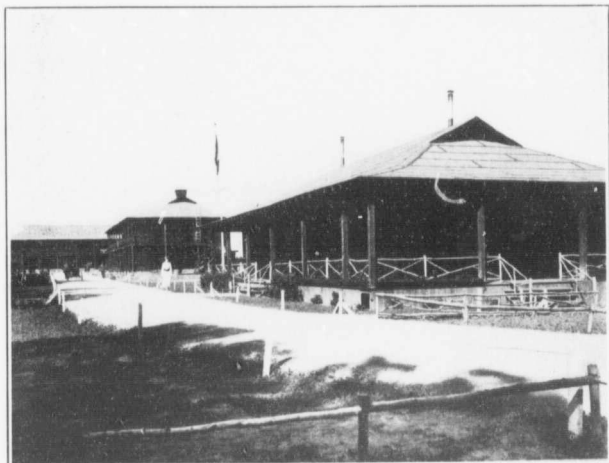
time he is equipped with a camera gun, and expected to manoeuvre into a position favorable for attacking another machine, simultaneously avoiding being photographed himself by an opponent.

This brought about marked proficiency, and it was proved quite clearly that pilots had been going overseas with too much straight shooting and not enough practice during stunting. The new system, however, brought tuition up to conditions actually existing at the front at the time. Several experienced pilots became available, and their lectures were most valuable. The output of cadets was (June) 182, but the average flying had gone up to 11 hours.

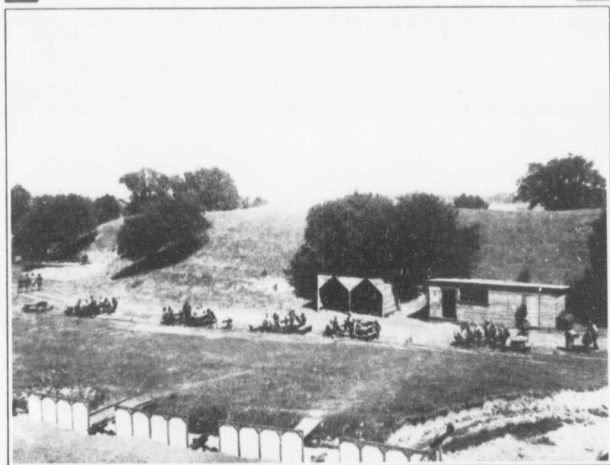
In July the School became that of Aerial Fighting—a more descriptive title, since tactics were so prominent in its course. The contrast with June of 1917 was somewhat remarkable, there being now 92 officers and 700 other ranks. During this month rocking nacelles and Scarff mountings were introduced for all ground work, and all pilot instructors were arranged to be examined monthly. This led to the discovery that refresher courses were necessary in cases, these being forthwith commenced. The month's output was 262, with flying time with guns of 11 hours.

In August, the observers' course was well under way, being a modification of that arranged for pilots. There was naturally no C.C. shooting, but instruction covered every practical method of firing at possible targets from the observer's seat. This month there were graduated 246 pupils with a slightly reduced flying time of $9\frac{1}{2}$ hours.

By September pupils were passing all tests under the same instructor in any one squadron. This, coupled with the use of speaking tubes, was of considerable help. Further guns, gears and equipment had come in from England, and the situation was now vastly different from that which pertained to earlier months



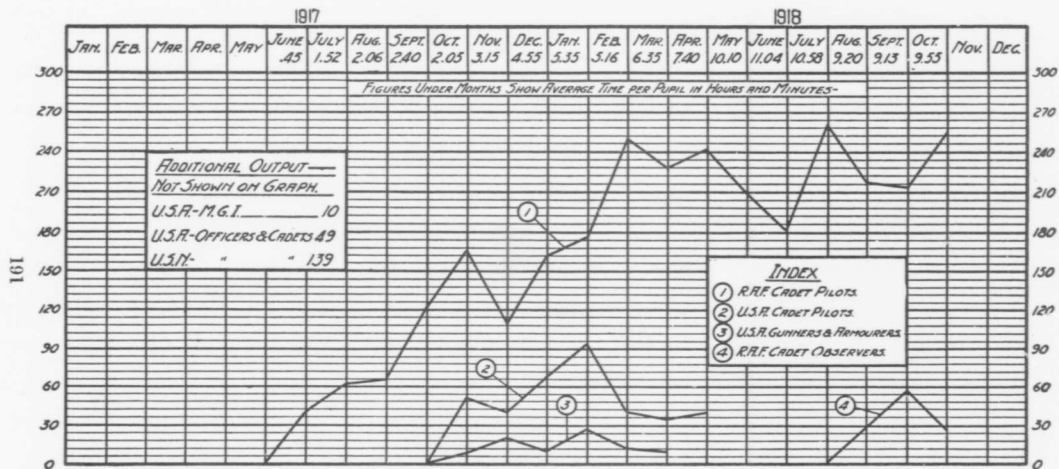
WING OFFICE, ETC.—BEAMSVILLE. ✓



RANGES—BEAMSVILLE. ✓



CABLE WAY FOR GUNNERY PRACTICE, TEXAS.
(SINCE OUT OF DATE).



R.A.F. CAN.- OUTPUT OF PILOTS - SCHOOL OF AERIAL GUNNERY

when the School was forced to manufacture much of its own equipment. Instruction was going well, and the output reached 270, with a flying time of more than 9 hours.

The officer personnel expanded in October to 110, this being of great assistance. Pilots were limited to three hours per day in the air, and, in consequence, machines had not been reaching a maximum flying time. The effect of good instruction at the Armament School was now most noticeable, as pupils were coming through with increased technical knowledge of gunnery and guns. The first Canadian-built Avro machine was flown during this month, with a most satisfactory performance. The output touched 281 and flying time 10 hours.

Such in brief is the record. The value may best be judged by the service rendered by those who passed from the harmless silhouettes floating on the smooth surface of Lake Ontario to engage the deadlier machines that haunted the high altitudes over the Western front.

CAMERA GUNNERY.

Before carrying out aerial practice with machine guns, embryo pilots and observers are required to attain a certain standard in camera gun work, both on the ground and in the air. The camera used is designed to resemble, both in operation and in appearance, the Lewis machine gun, the difference being that upon the trigger being released the camera gun registers a photograph upon a film. Reloading is by pulling back the cocking handle, which brings another film into place.

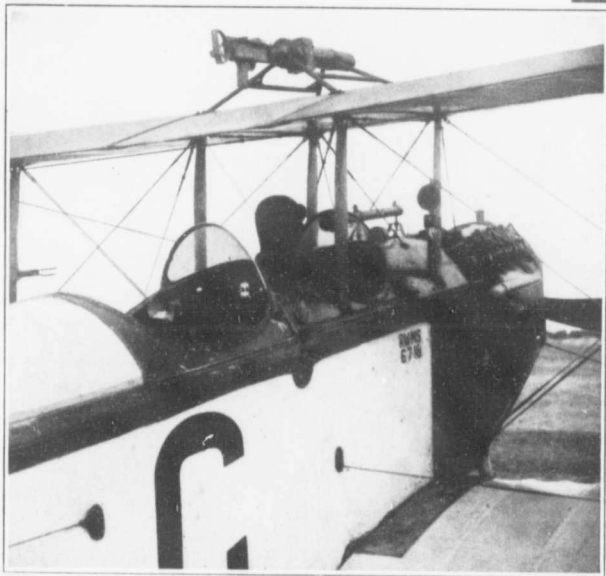
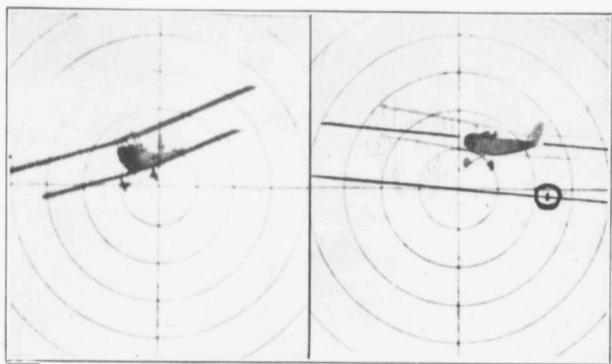
Practices being concluded, the cadet takes his own film to the nearest photographic sub-station, where it is developed in about ten minutes, and, still wet, is then submitted to the instructor, who forthwith criticizes the work of his pupil in the presence of the latter.

The camera gun is best suited for enabling the pupil (pilot or observer) to ascertain his proficiency in the use of deflection sights, and his ability to place the enemy machine in correct position in the ring, according to his line of flight. Errors in aiming are checked by the photograph being taken through a glass screen, this being marked with circles, each valued at seven and a half feet taken from 200 yards' distance, which is the distance advised for commencing a combat. On examining the film, after development, the instructor can explain the error in deflection or elevation by the position of the machine in relation to the rings.

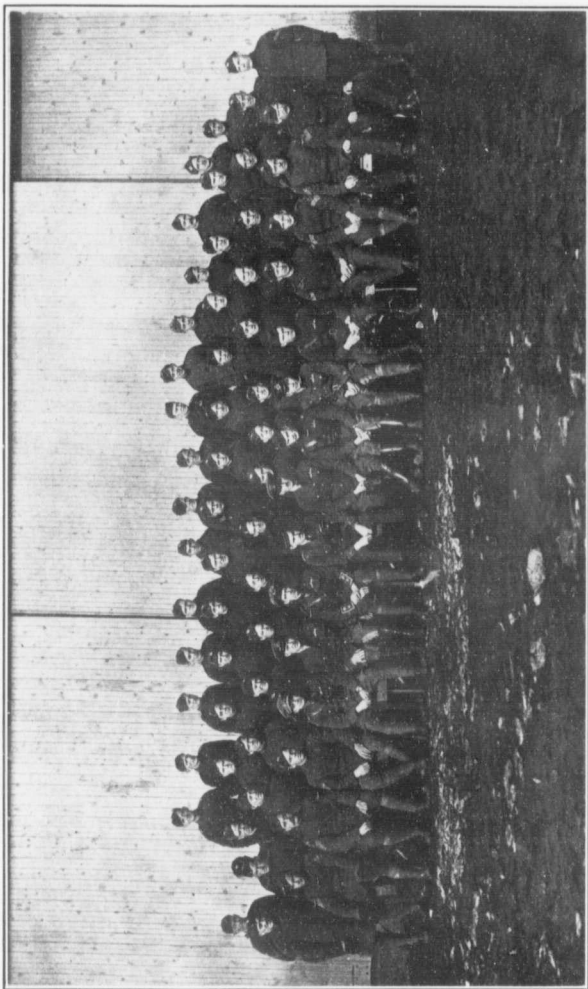
In the illustrations, these being from camera gun films, will be noted the enemy machine as seen by the gunner through the ring sight at the moment of firing. In the first case the aim is low and to the right.

In the second print the pupil has fired low and in front. The encircled dot shows the point at which the gunner should have aimed when the pilot of the target machine was flying directly toward the inner ring at 100 miles per hour.

On taking to the air with the camera gun, the observer is piloted by an instructor, and is initiated not only in the photographing of other machines, but also in manoeuvres which have for their object the avoidance of being photographed by the opposing camera gun. Finally, the pupil engages in aerial combat with another machine piloted by a "hostile" instructor, and each machine attempts to "shoot down" the other. In this contest the pilot or observer who obtains the most accurate pictures is counted the victor. Every principle of aerial fighting as taught both in lectures and in the air, is practised, and upon its completion the results, as inflexibly registered by the camera gun, are subject to the keenest criticism.



CAMERA GUNNERY. ✓



82ND SQUADRON

WIRELESS.

It was, of course, recognized from the very first that thorough acquaintance not only with every means of communication from the air to the ground, but also ability to read every signal necessarily transmitted from the ground to the air, was one of the most important requirements in the training of a pilot.

The ranging of guns (particularly heavies), the finding of targets and their destruction have all been successfully accomplished by coöperation between the pilot and the communicating battery. Numberless devices have been experimentally tried such as coloured lights, signalling by lamps, etc., etc.; but none proved a means of communication which was not only reliable but which also afforded no invitation to attack by the enemy. As the outcome, the wireless system from the aeroplane to the ground, and ground strips, or panneau, from the ground to the aeroplane were adopted and uniformly used. As far as concerns the training work of the Canadian wing of the Royal Flying Corps, the methods used were naturally those already established in England.

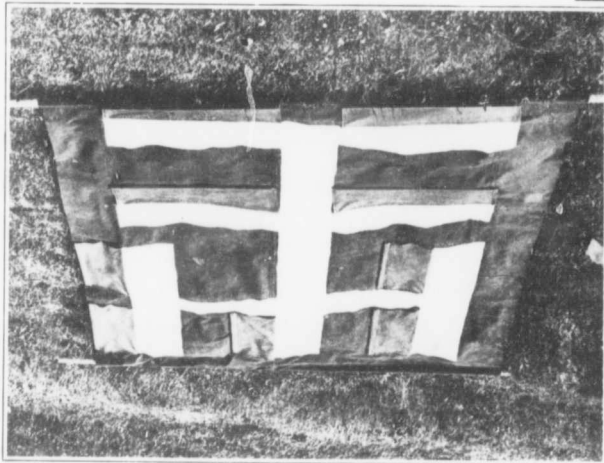
On arrival at the Recruits' Depot, the cadet received his first initiation, together with a small amount of instruction in the code used. Moving hence to the Cadet Wing at Long Branch, wireless formed a definite part of the routine of the day's work. The cadet was required to successfully send and receive six words per minute, and for purposes of instruction telephones were connected to the buzzer circuits. In the tuition of sending, Morse recorders operated by means of a silenced key were installed, and picture targets, constructed with miniature lamps shining haphazardly through small holes, were operated from a switchboard. These represented shell bursts

which the cadet was required instantly to locate and report.

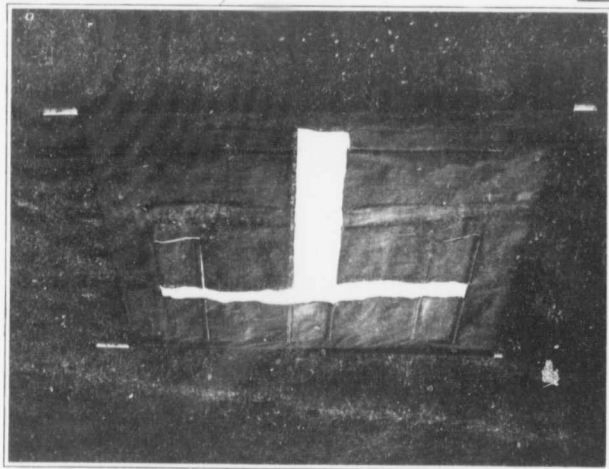
With six weeks' of wireless at the Cadet Wing, the pupil proceeded to the School of Aeronautics for further instruction, and heard lectures on picture target work and artillery coöperation from experienced observers. Requirements now demanded eight words per minute. After examination, his next step was to the elementary training wing at either Deseronto or Borden, where he not only carried on ground work, but also put into actual practice in the air the instruction already received.

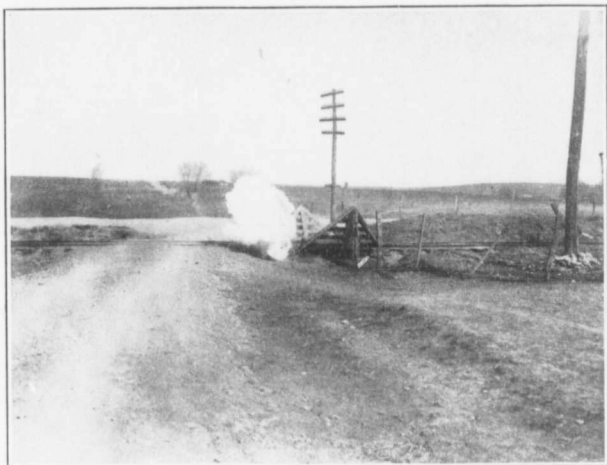
Moving on to North Toronto he reached the stage of final tuition in this section of his course. At varying distances from this station, puff targets were provided to simulate shell bursts, and the embryo pilot conducted himself as though on active service by locating the shoot and reporting it with necessary adjustments to the battery receiving station. Such was the value attached to this phase of training, that eighty per cent. of the observations sent down were required to be correct before the pupil was considered passed. The tests included reading ground messages, bomb dropping, etc., the latter being checked by a camera obscura hut which was used as the target. In this process it was necessary that the cadet adjust his bomb sights both for the speed and altitude of his machine. This being done, his wireless key was depressed and the actual position of his machine recorded in the camera obscura hut at the moment of signalling, which moment, it was understood, was the instant at which the bomb would have been dropped were the machine in actual service. The result recorded infallibly the amount of judgment which had been used. Some idea of the extent of this School may be gathered from the fact that a tour around the batteries involved a 60 mile trip. Bomb-dropping, though having no connection with artillery observation, was here practised as a matter of convenience.

ПОПНАН ПАННАВУ

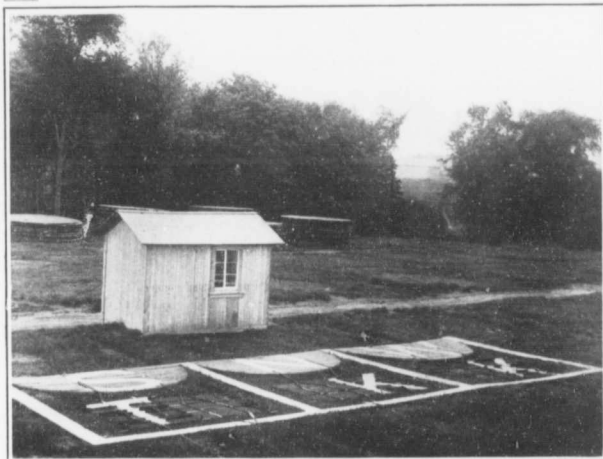


ПОПНАН ПАННАВУ





"A PUFF,"



GROUND STRIPS.

If it be asked why the pilot does not receive as well as send wireless messages while in the air, it may be stated that up to the present the difficulties of receiving on a trailing aerial have been such that what might be termed a graphic ground method has proved preferable. Large ground strips are, on active service, an invitation for bombardment by the enemy and are being aided by the Popham Panneau, a method of signalling consisting of the rapid forming up of small, symmetrical, rectangular figures, by arrangements of white bands capable of rapid variation. In general they are the combination of the letter "T" with short, symmetrical additions.

The Aldis lamp, also used, is an improvement on the heliograph, and reflects the rays of an electric globe instead of sunlight, but it will be understood that recent advances in wireless telephoning have revolutionized the above methods.

A word is in place with regard to the Artillery Coöperation School at Leaside through which all pilots of necessity must pass. The equipment is the result of very brilliant work by an R.A.F. officer. The maps themselves represent two sections of the Western front, and are reproduced with vivid accuracy from aerial photographs. Each is 40 feet x 20 feet, and contains some eighty targets so arranged as to allow switching from one gun pit to another, thus following the actual work of destruction by imaginary batteries. Zone calls are arranged for all targets, these representing every possible point for bombardment, such as hostile battery positions, trench points, railroads, cross roads and fortified positions in enemy towns. British and German trenches are shown on a scale of approximately five inches to one hundred yards.

The total number of electric globes used to simulate bursts is 1,360, and the two balconies where the observing pilots sit are so equipped that every operation which must be carried out in doing wireless tests

must be completed before signals can be received by the operator seated below at the imaginary battery. Space does not permit of a detailed description of the intricate, electrical work required to complete this admirable installation. It suffices to say that those best qualified to judge deem it a very considerable achievement.

Rotary targets are also used, as by turning them practically the same condition is created as that which confronts the pilot when turning his machine in the air. These, too, represent a reproduction of well-known sections of the Western front.

A special map was devised for contact patrol work, presenting three distinct lines of trenches together with an equal number of groups of headquarters, as well as machine gun pits, tanks, etc., while wireless sending was coupled up with Aldis lamp work—the latter requiring to be read at four words per minute.

At the conclusion of instruction of every course it was demanded that every cadet both receive and send at a speed of eight words per minute before being allowed to proceed with aerial tests.



WIRELESS IN THE FIELD.



MOSAIC OF CAMP BORDEN R.A.F. AND PART OF C.E.F. AREA. ✓

1. CANVAS MATS AND MACHINES.
2. HANGARS
3. LANDING SQUARES.
4. MACHINE GUN SHELTER.
5. CADET CAMP.

6. SAND PATCH.
7. WOODED GROUND.
8. OFFICERS' QUARTERS.
9. RAILWAY.
10. EARTH ROAD.

11. BARRACK BLOCKS.
12. BORDEN STATION.
13. PATH.
14. GOLF COURSE.
15. QUARTERMASTER STORES.

[Examine this photo with a glass.]

PHOTOGRAPHY.

The Air Force is the eye of the army, and the camera the recording eye of the airman. It is therefore, of prime importance that aerial photography in all its phases be mastered by the would-be pilot. Failure cannot be risked. Too much is involved in sending machines on long photographic reconnaissance. Their results should indicate everything from a narrow path through enemy wire to a camouflaged German aerodrome.

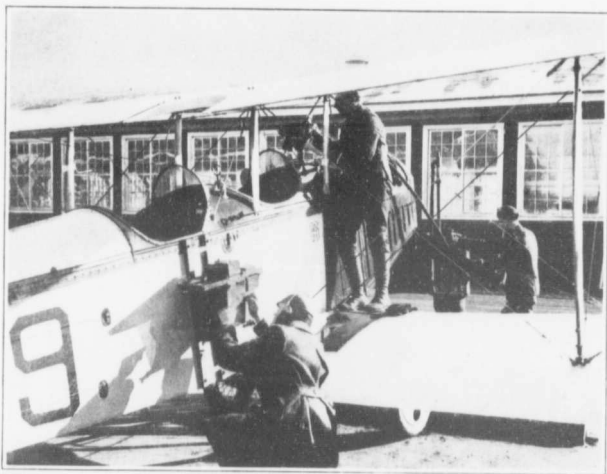
In order to secure the best type of instruction, the R.A.F. has availed itself of the services of officers of experience on all points. Training begins at the School of Aeronautics. Here ground tuition is given, including everything from camera mechanism to colour filters and panchromatic plates, from map making to mosaics, the relative size of objects and the value of shadows in estimating heights.

Leaving the School, the cadet takes to the air to be tested by photographing given points, his ground instruction still proceeding. In the case of the observer, the course is the same, and all such work forms part of a general mapping scheme which aimed at the compiling of a complete reproduction of the areas around the several aerodromes.

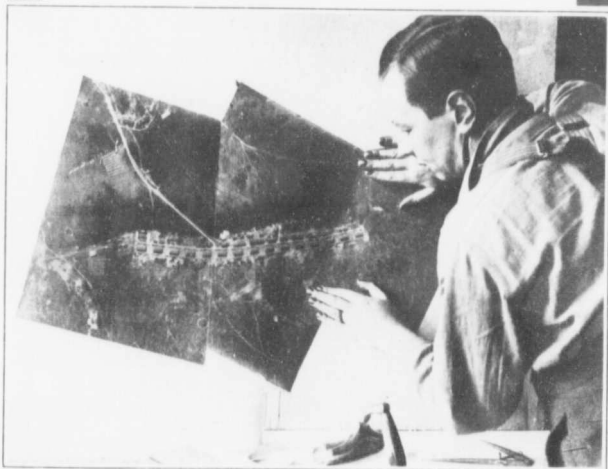
Bad weather, usually considered a bugbear, is not allowed to interfere. By the use of a wide shutter slit and the very best lenses, tests are made in all weathers, and active service conditions thus paralleled. That photographic instruction has been faithfully given and intelligently received, may be seen from the excellent reproductions of aerial work presented in this volume.

From the foregoing it might be assumed that the art is simply acquired, but such is not in any way the

case. To use his lens with complete facility, the pupil must correctly establish his height, his relative position with the objects to be photographed, and, generally speaking, be sufficiently at home in the air to do his flying instinctively and devote his chief attention to the camera.



ATTACHING CAMERA TO FUSELAGE.



BUILDING UP A MOSAIC. ✓



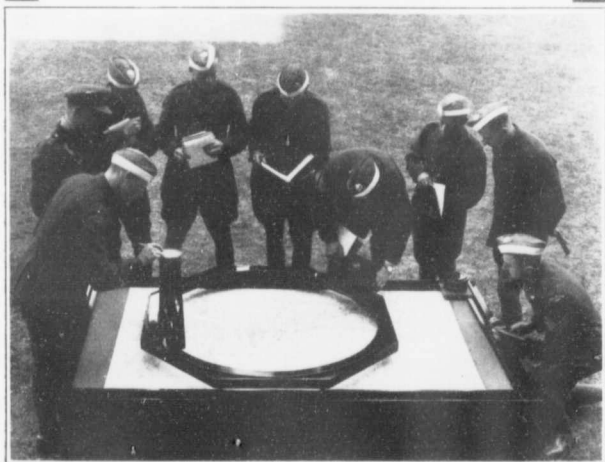
RECEIVING.



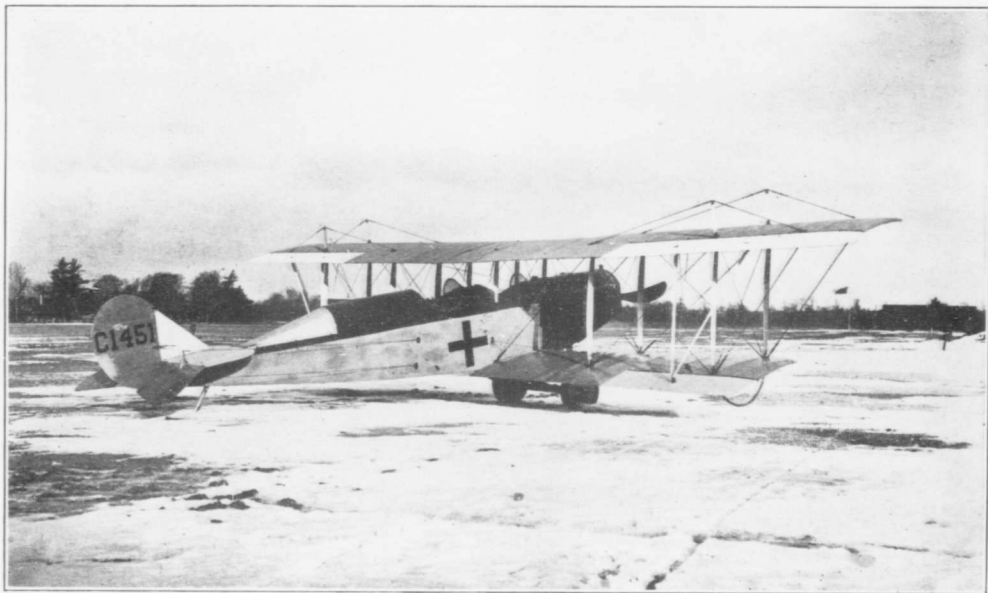
ARTILLERY OBSERVATION HUT.



PHOTOGRAPHY. ✓



AERIAL NAVIGATION. ✓



AERIAL AMBULANCE.

ARMOUR HEIGHTS SYSTEM.

Training development in England had now reached a point at which elements already recognized but not hitherto fully appreciated were proved to be invaluable. Their use was aimed primarily at the attaining of instinctive flying by the pupil. The means by which this was achieved, the consequent effect on the instructor, and the reduced fatalities during instruction are sufficiently notable to call for mention.

The product has been the active-service pilot as distinguished from the peace pilot—two vastly different individuals.

The actions and reactions of this system are in general psychological. They begin with the assumption that since fear is almost invariably of the unknown, once the latter is eliminated fear should be non-existent. The approach is, therefore, by way of wiping out ignorance concerning the air and the machine in which the pupil and instructor ascend, and illustrating, while in flight, the simplicity of those laws which are fundamental to all good pilots and machines.

This, while seemingly simple enough, involves an ultimate strain on the instructor. His pupils are, it is true, limited to six, but into each of these he is expected to pour the sum of his knowledge and skill. He is personally responsible for their crashes. At first blush apparently unjust, this resolves itself into an absolutely fair deduction from the principles of the system. A crash by a pupil—engine failure and aeroplane failure being too infrequent to alter the premise—is considered as due to an imperfection of training. At some stage in the course some indispensable point must have been slighted or overlooked. Hence the pupil's inability to meet the emergency.

Character—that subtle union of temperament and disposition, the increasing air sense, the delicacy of control, the spontaneous response, the nameless faculty by which the pupil becomes, as it were, welded to the machine which in turn replies to the subconscious movement of hand and foot—the study of all these are found in the Armour Heights system, which itself is based on an admirable method originated at Gosport, in England. The pupil is expected to do the flying, and even in an emergency the instructor does not assume control until it is demonstrated that the pupil is literally out of his depth.

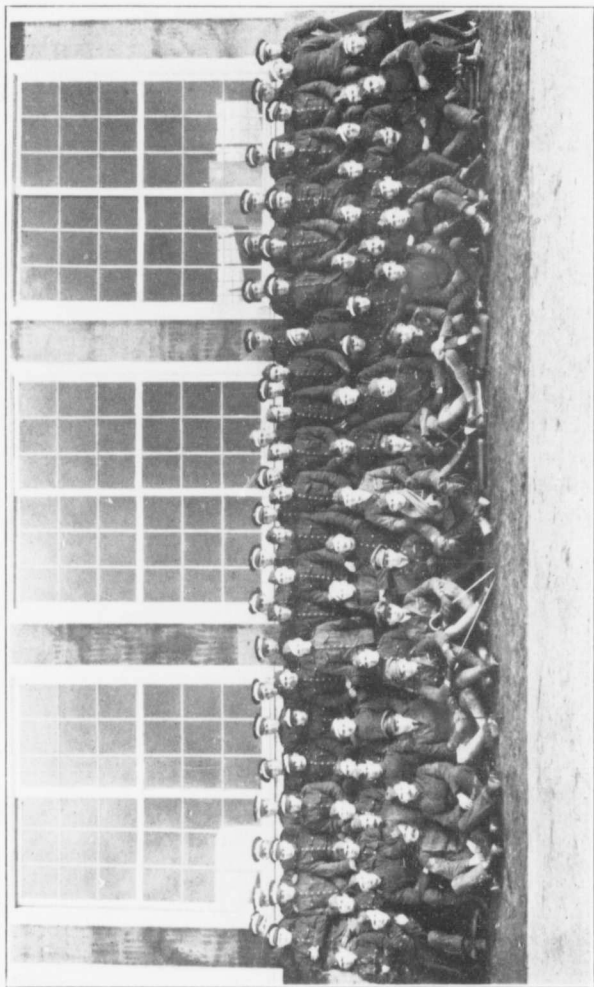
And always by telephone or tube sounds back from the front seat the guiding voice, encouraging, reproving, suggesting and probing the mental process of the pupil at the moment. Take, for instance, the spin, that plunge easy to commence and equally easy to terminate. The machine slows, stalls, dips and dives earthward. At the second spin comes steadily in the word of experience—"stick a little forward—not too much—right rudder—hold her there—that's right—easy isn't it?—feel all right?—let's do it again—put her in yourself this time." With such an "entente cordiale" as this, it is clear why the words "danger" and "nerves" are barred from the instructor's vocabulary, and the terms "safe" and "dangerous" give place to "right" and "wrong." The pupil has obtained the sense of relationship between himself and his machine.

It is admitted that the art of instruction is difficult from the lecture platform, but how much more arduous when weaving circles at 5,000 feet, with an invisible tyro in control. Confidence is born quickly in these high altitudes, but since the system looks to the instructor, rather than to the pupil, the strain on the former is commensurate with the added advantages extended to the latter.

Herewith a few excerpts from an admirable syllabus issued by the Air Ministry in this connection. They are curt, valuable and saturated with experience:—



"A CENTAUR OF THE AIR."



SIXTH SQUADRON—CAMP BORDEN

“Put the pupil in the pilot’s seat from the very beginning.

“Control your pupils in the air entirely by word of mouth through the speaking tube.

“When a pupil makes a mistake in the air let him first exhaust his own ideas of how to put things right if height permits.

“Make it a point of honour to allow pupils full control, except, of course, in cases of emergency.

“Your greatest duty is to inspire your pupils with confidence in themselves, in their machines and in you.

“If the weather is too bad for instruction, you should fly yourself for the sake of the spirit it produces.

“Every time a pupil does something in the air he has never done before he increases his confidence.

“Instructors are responsible for the crashes of their own pupils, and the saving of a crash compensates for any amount of additional dual control.

“Have all your machines rigged properly, and fly them frequently yourself to see that none get into a bad condition.

“The time available during training is ample for a pupil to be made a real pilot, provided he makes up his mind never to waste time in the air and is taught, not left, to teach himself.”

The progress of instruction is roughly indicated below, this sequence of manoeuvres having been developed in Canada to suit local conditions and the general type of pupil available:—

Demonstrate effect of the controls.

Flying straight, level and climbing.

Turns.

Misuse of controls in turns.

Difference in control with the engine off.

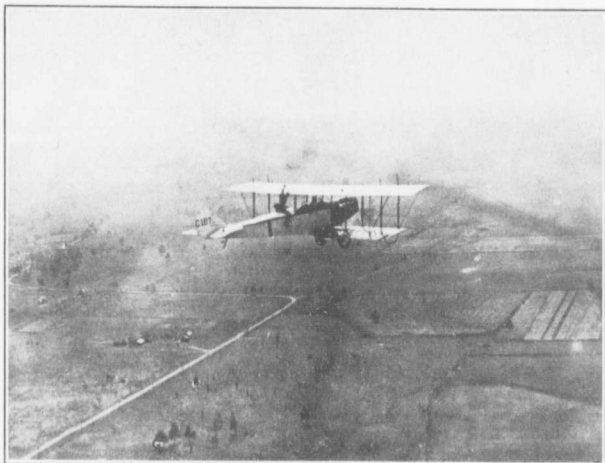
Glide.
Stalling.
Slow flying.
Gliding turns.
Taking-off into wind.
Landing into wind.
Approach.
Spinning, etc.

The pupil now goes solo.

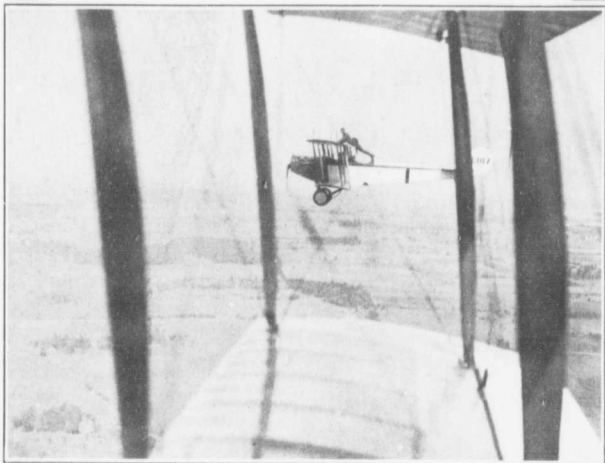
Steeper turns, with and without engine.
Climbing turns.
Flutter glide.
Side-slipping.
Taking-off and landing across wind.
Landing on a mark.
Forced landings.
Higher manoeuvring.

From the moment of introduction of the Armour Heights system, a modification of the training of instructors became necessary. The psychological phase of the new method demanded recognition, and steps were taken forthwith to analyze and increase the personnel of aerial tuition at all units. The School of Special Flying resolved itself into a station of five products, as indicated by the graph given herewith. The value of each class to the Royal Air Force, Can., has been inestimable.

The crashes resulting in fatalities showed, under the new Armour Heights system, a notable decrease as evidenced by the chart on page 218. To realize the full significance of this chart, it is necessary to remember that the pilot who is an "Armour Heights graduate" has performed in the air every manoeuvre of which his machine is capable. He has solved all aerial problems. Whatever protective agencies human skill and experience could formulate were put into operation, and the record in respect of fatalities is so low as to be a tribute to the ceaseless care exercised.



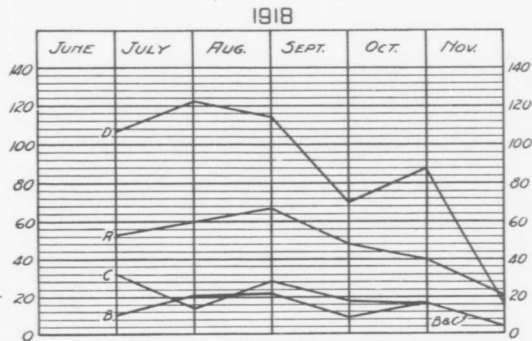
"PEGASUS"



ACROBATICS.

912

INDEX
 'A' - THE MACHINE IS WRITTEN
 OFF AND USED AS SALVAGE
 'B' - TWO OR MORE LONGERONS
 ARE BROKEN.
TOTAL CRASHES FOR JUNE - 204.



INDEX
 'C' - ONE LONGERON IS BROKEN
 'D' - UNDERCARRIAGE OR PLANES
 ARE BROKEN AND REPAIRABLE
 BY WING.
TOTAL CRASHES FOR NOV - 47

RAF CAN - CRASH COMPARISON SHOWING EFFECT OF
 INTRODUCTION OF THE ARMOUR HEIGHTS SYSTEM

And if it should be asked why those phases of the system which may be termed its humanities are of so recent development, the answer lies in the fact that what is termed "air sense" called for an investigation of personal phenomena in respect of which science had not a single landmark. Men watched the bird curving its wings to invisible gales, and hazarded numberless theories. Early machines were tricky compared to their successors. They lacked present efficiency, reliability and simplicity. The sum total of the powers of the pilot were busy meeting mechanical difficulties, and there was little opportunity for excursions into the psychology of the new art. The honour of service is equal, but the pilots sent overseas by the R.A.F., Can., in 1918, have in comparison with the pilots of 1914 a vastly superior technical and mental training. They have advanced step by step with the world's knowledge of the air.

To reduce it to a sentence, the system of to-day turns out a pilot who is subdivided, so to speak, into two sections. One is subjective and does the flying. The other is objective, free for retreat or pursuit, defence or attack or any of the countless situations of aerial warfare which call for swift and fearless action.

SCHOOL OF SPECIAL FLYING.

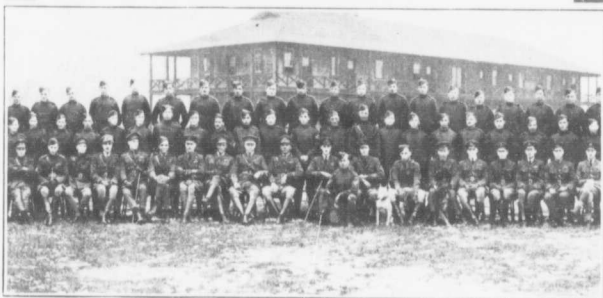
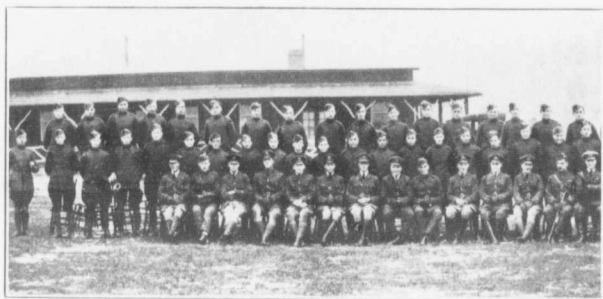
The Armour Heights special course for instructors commenced on or about April 1st, 1918, with one squadron detailed for duty. As will be inferred, this was the direct outcome of the adoption and further development by the R.A.F., Canada, of the method of tuition known as the Gosport system, then in use in Great Britain.

It might be well to explain that the Armour Heights course differs in important respects from the instruction given in England. Up till the present, it was not considered that the JN4 machine, as used, was capable of performing all higher manoeuvres, such as rolling, looping, etc. It had therefore been, so to speak, set aside by the British authorities for what might be called lower training. The higher and more difficult evolutions had been reserved until the pilot went overseas and was trained in the use of fast, service machines. With the Canadian JN4, however, all the higher manoeuvres were now performed by speed and not by engine power. This naturally necessitated considerable dexterity of manipulation.

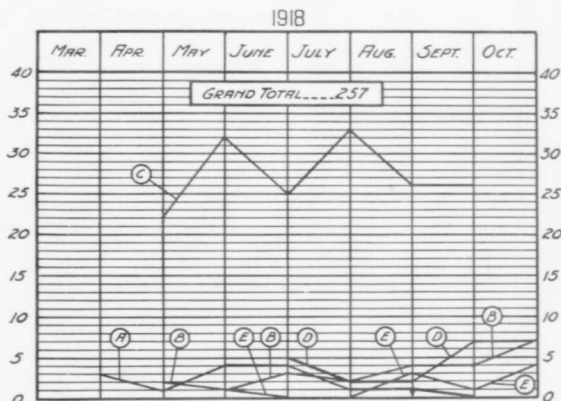
By the first of July, ninety-five instructors were passed out of the School. On this date a second squadron was absorbed for the purpose of tuition and the School of Special Flying came into existence, with thirty-six machines and an average of twelve instructors.

At the beginning of October an output of sixty for the month was counted on. This was lowered to forty-two, owing to the severe epidemic of influenza then prevalent, which considerably reduced the number of serviceable instructors.

The primary aim of the tuition has been to obtain smooth and correct work and a light-handed method of



OFFICERS AND STAFF—SCHOOL OF SPECIAL FLYING.



INDEX

- (A) QUALIFIED FOR INSTRUCTOR AT S. OF S.F. OR TO BE WING EXAMINING OFFICER.
 (B) QUALIFIED TO INSTRUCT IN HIGHER MANOEUVRES AT S.R.F.
 (C) QUALIFIED TO INSTRUCT CADETS AT FLYING WINGS (4200 & 4400)
 (D) QUALIFIED TO INSTRUCT IN FRONT SEAT FLYING AND LANDINGS AT S.R.F.
 (E) QUALIFIED TO FLY OBSERVERS AT S.R.F. OR 43RD WING.

TOTAL NUMBER OF DUAL FLYING HOURS = 2833

TOTAL NUMBER OF SOLO FLYING HOURS = 6937.20

R.A.F. CAN.-SCHOOL OF SPECIAL FLYING - OUTPUT OF PUPILS

flying, as it was found that when pilots used perforce only JN4 machines they were apt to develop a somewhat heavy touch, unless extreme care was exercised. Stunting and contour chasing were particularly encouraged amongst instructors and others with sufficient air experience, and since the duty of the School was to instruct instructors, the personality of the latter was always considered a determining factor entirely apart from ability as a pilot.

An important duty performed by the School, was the calling in of most of the instructors then in the brigade, in order to thoroughly acquaint them with the new methods involved in tuition as given in the Armour Heights course. This proved entirely justified.

It was found, also, that even in the case of most experienced pilots, who had been flying fast machines overseas, great advantage was secured by taking the course, since it was required that they depend to a much greater extent upon correct flying, far more skill being required to do higher manoeuvres on a low-powered machine.

The dual time put in by instructors who passed out for wing duty was reduced from fourteen hours to eight hours in the course of four or five months, as a result of better instruction at the wings, this being indirectly due to the fact that the instructors under whom they had flown in each squadron had themselves been through the Armour Heights course. It was found that three hours' solo to one hour of dual instruction was most advantageous.

The above notes give very baldly an outline of the purpose of the School, and it will be found necessary to take them in conjunction with the chapter on the Armour Heights system in order that the essential elements of this tuition may be fully realized.

FLYING ACCIDENTS.

The "crash" diagram is, after all, the most definite and conclusive record of the success or failure of any system of flying instruction. Its facts are incontrovertible.

During the earlier period of the history of the Corps in Canada, there was, of course, in use a constantly broadening system whereby the details of all aerial accidents were instantly forwarded to headquarters. It was not, however, until the Armour Heights method had been in definite operation for some months that it became possible to re-analyse the then existing procedure in the light of new knowledge, and evolve a form of records which completely reflected all the various instrumentalities which required diagnosis.

This statement carries no reflection on either the instructors or the methods of instruction pertaining to the first year's operation of the unit. As in all its other activities, out of experience came knowledge, the application of which was instantly undertaken. We find, then, that during the summer of 1918 not only were the salient features of the crash carefully investigated, but also all those possibly contributory causes in some one of which will almost certainly be found some vitally important feature.

The first procedure was to classify the crash. The method adopted will be seen in the index of the graph on page 229. Prior, however, to this classification, which of course is only established by means of close technical examination of the damaged machine, the unit to which the machine belonged sent to headquarters by telegraph or telephone, whichever was the faster, the following information:—

- (1) Regimental number, rank and name of personnel concerned, stating which is pilot and which is passenger.
- (2) Injuries sustained and by whom.
- (3) Précis of accident.
- (4) Time and date.
- (5) Type and number of machine.
- (6) Number of hours solo and dual flown by casualty.
- (7) Whether next-of-kin has been notified.
- (8) Whether Canadian press (if necessary) has been notified.
- (9) Whether court of enquiry is being held.

The next procedure was to further analyze the accident by establishing as quickly as possible all facts which might tend to elucidate information. Under the nine succeeding headings come also certain crashes from one or more contributory causes—the latter to be further classified in relative proportion, whether primary or secondary.

- i. Aeroplane defect—
 - (a) Breakage.
 - (b) Engine failure.
 - (c) Faulty rigging.
- ii. Error of judgment—
 - (a) Not due to poor instruction.
 - (b) Probably due to poor instruction.
- iii. Loss of head.
- iv. Brain fatigue.
- v. Fear.
- vi. Physical illness.
- vii. Unavoidable.
- viii. Disobeying—
 - (a) Rules of the air.
 - (b) Instructions for that flight.
 - (c) Standing orders.
- ix. Weather (wing visibility, temperature effects).

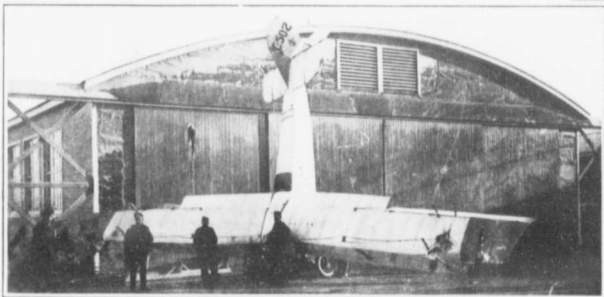
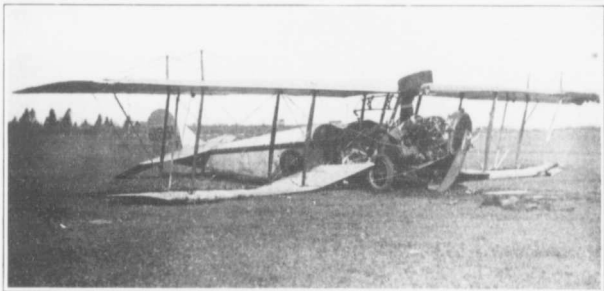
As some accidents will have one or more contributory causes, they will be shown under two headings:—

Primary cause.

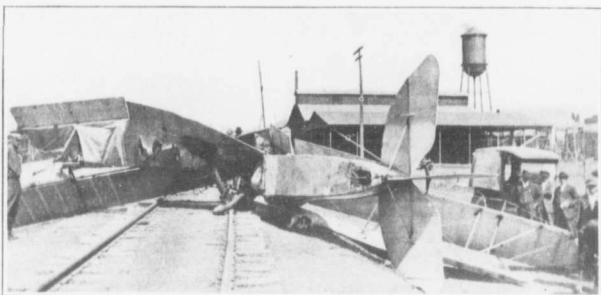
Secondary or contributory cause.

It will be seen at a glance that the bringing forth of this information involved reference to records already in existence, and which had been maintained with particular care in order they might be fully available when thus crucially needed. There was sent, furthermore, specified information with regard to certain possible contributory causes, such as "loss of head," "brain fatigue" or "fear." Under "loss of head," for instance, it is pointed out that the pupil in his new occupation of flying, especially for the first time, has every mental faculty on the alert at extremely high tension, and that the sense of danger, although not asserting itself, is also subconsciously present. It follows, therefore, that under the strain of an emergency the power of synchronized decision and act may lapse—this lapse resulting in what is known as "loss of head." When there is added to this the fact that in flying, not only seconds, but parts of a second count enormously, it will be clear that after an actual loss of head there is seldom time to correct an error.

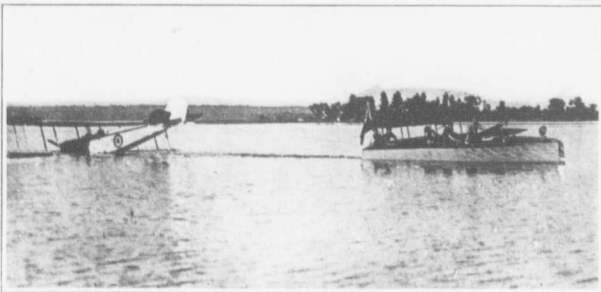
"Brain fatigue" and "fear" are allied to "loss of head;" when the pupil reaches the stage in which he has neither the power to reason, decide or act. Then supervenes a state of mental inertia due to the swiftly repeated stream of impulses received in rapid succession by his brain. He begins to feel alone, and unable to assume control. Errors occur, and he becomes overwhelmed with the enormousness of the whole thing. Follows a state of brain fatigue and stupor, during which he awaits events and takes little part in the control of his machine. After such an accident, the pupil has generally no recollection of what has happened. His memory seems to be partially stunned. Under these circumstances, it seldom occurs that



TYPES OF CRASHES.



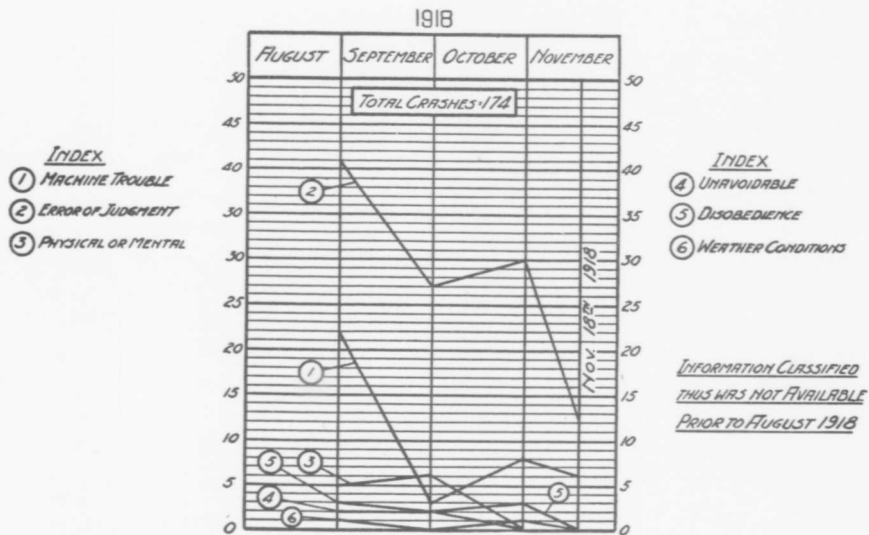
A TEXAS CRASH



AT DESERONTO.



AT DESERONTO.



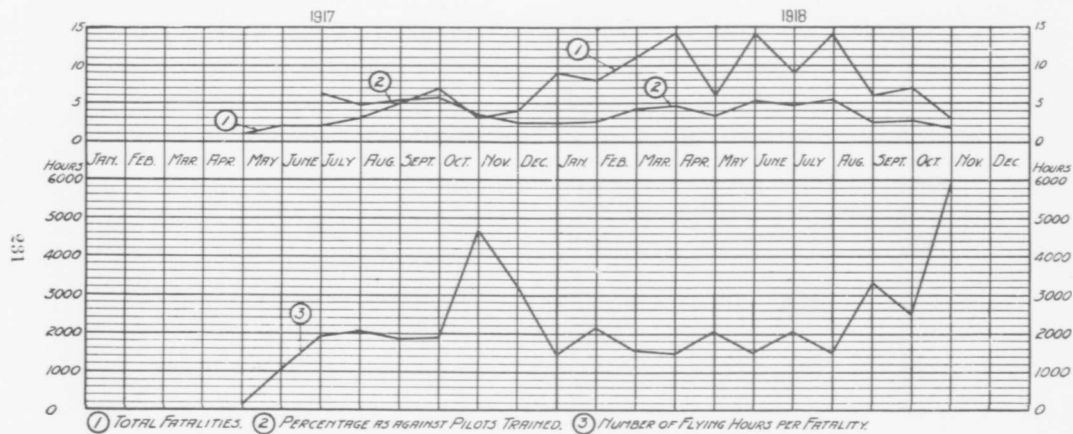
RAF. CAN. - CRASHES ACCORDING TO CAUSES

he resumes flying—his temperament as a general thing proving to be unsuitable.

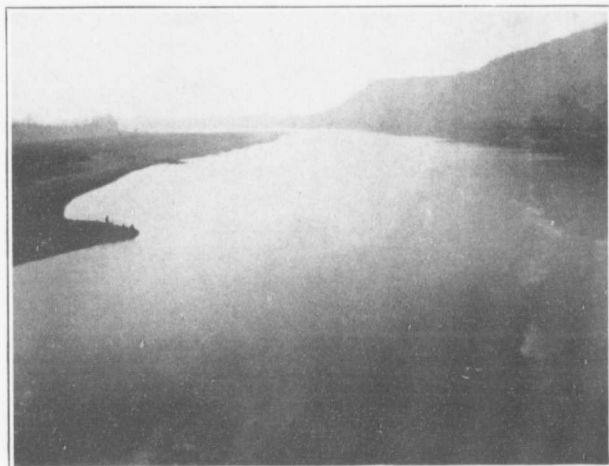
It is important that "brain fatigue" should be sharply separated from "fear." The latter is rarely experienced in the air on the first few solo flights, the pilot's mind being far too much concerned with the details of flying, watching the various instruments, and in checking his position and direction in the air relative to the ground. Many confess to a lurking sense of danger, but all say that it rarely if ever asserts itself.

Turning again to the graph on page 218, and now keeping in mind the classification of crashes, it is interesting to note that, owing to the introduction of the Armour Heights system, crashes in which the machine is totally wrecked were reduced from 53 in the month of June to 21 in part of the month of November. "B" and "C" crashes in which longerons are broken, were reduced from 43 in June to 12 in November. "D" crashes, which are those affecting only the under-carriage or planes, and are usually due to rough ground being insufficiently allowed for, or too late a pull back on the control ere the machine comes into contact with the earth, fell from 107 to 16. While the general reduction is most gratifying, the improvement in the acquirement of a delicate control necessary to make workmenlike landings is remarkable.

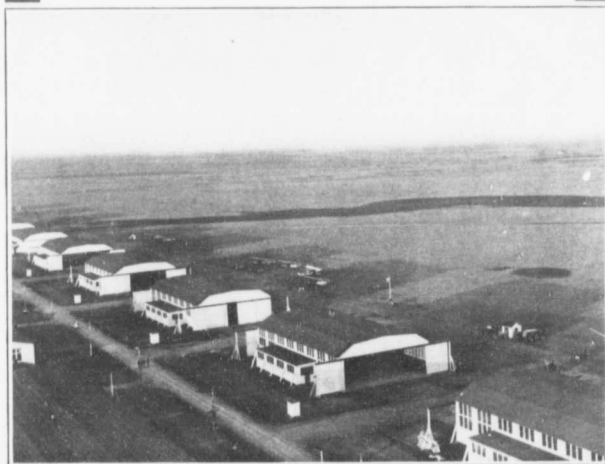
It will be observed that although training was continually being intensified, fatalities decreased from 1 in 1,760 hours' flying in July, 1918, to 1 in 5,300 hours' flying in October, 1918, and this in spite of the fact that pilots were doing all aerial manoeuvres. Official data from other training centres, where work was done on varying types of machines, show 1 fatality for 1,170 hours' flying.



R.A.F. CAN.-FLYING FATALITIES



LAKE WORTH.



PART OF BENBROOK.

THE R.F.C. IN TEXAS.

The entry of the United States into the war affected almost immediately the programme of the R.F.C. in Canada. There was now next door, instead of a neutral if friendly nation, a vast organization associated with us in the greatest of all undertakings, and when in April the O.C. was authorized to visit the War Department in Washington and discuss a reciprocal scheme for training pilots, he found the U.S. authorities animated by the keenest possible spirit. The idea of coöperation was attractive to both services. It would not only stimulate a most desirable comradeship between the two, but would be of direct assistance to the U.S. Signal Corps in training their tremendous reserves of admirable recruits, as well as possibly obviate the necessity of the R.F.C. forming a fourth wing in British Columbia, where the preparation of aerodromes was already under way.

The move was preceded by formal communications between the two governments, but the details of organization, equipment and training, on behalf of the British, rested with the O.C., R.F.C., Canada. Briefly they were as follows:—

(1) The R.F.C. was to train ten squadrons for the U.S. Signal Corps, comprising 300 pilots, 144 other flying officers, some 20 administrative and equipment officers and approximately 2,000 mechanics. This training was to be commenced immediately in Canada, and completed at Fort Worth, Texas. All training equipment, aerodromes, etc., in Canada to be provided by the R.F.C.

(2) The Aviation Section, United States Signal Corps was to provide in Texas, and equip with all the necessary buildings, water supply, etc., two aerodromes capable of accommodating 10 squadrons, and part of

a third for the Aerial Gunnery School; these areas to be occupied and under the control of the R.F.C.

(3) The Aviation Section, United States Signal Corps was to provide in Texas all aeroplanes, spares, running supplies (oil, gasoline, etc.), office and barrack fixtures and other camp equipment. The R.F.C. to supply gunnery, wireless and all other ground instructional equipment.

(4) Each service would provide its own pay, clothing and transportation, and draw rations on repayment during their stay in each other's country.

(5) The R.F.C. to supply all medical services in Canada, and vice versa.

This general arrangement was found to be mutually acceptable, and it was agreed, in addition, that the invaluable assistance of the I.M.B. in Canada, should be continued in Texas by the establishment there of a section of their purchasing staff.

Such was the proposal noted on the back of an envelope by the chiefs of each service, and it was carried out by both to the letter.

The brigade was already acquainted with the splendid pilot material available in the U.S., as many had enlisted in Canada, hoping to reach France at the earliest possible moment. Their record lives, and some of the success of the Corps is due to the admirable progress they made in training. They came — studied hard, and got into the air at every opportunity, breathless to join those forerunners whose names were already written large.

Commencing early in July, 1917, the brigade received for training from the U.S.S.C., about 1,400 enlisted men and cadets. A colonel of the Signal Corps describes them as under-officered, unorganized, unpaid, without records, and though one



CANADIAN WEATHER IN TEXAS.



TOWED TARGET FOR AERIAL GUNNERY.



EVERMAN, TEXAS.



PORTION OF HICKS, TEXAS.

hesitates—practically without uniforms. The immediate result for the R.F.C. was administrative chaos, but, in due course, matters were smoothed out, and when they returned south in the fall, they were already assuming a semblance of entity as United States Aero Squadrons.

On September 24th, 1917, the advance party left for Texas, composed of 4 U.S. officers and 50 men and 4 R.F.C. officers and 34 men, constituting a wing headquarters and a fatigue party, who, arriving in Fort Worth on September 26th, immediately proceeded to their headquarters in that city. They found there were three fields located north, south and west of Fort Worth, named, locally, Hicks, Benbrook and Everman, but grouped under the Signal Corps title of Camp Taliaferro, Fields Nos. 1, 2, and 3. Construction had been delayed through various causes. Barracks and aerodromes were incomplete. At one field building had been barely started. Water and light supply and sewage disposal had not been finished. Thus, although every effort was made to complete construction, it was nearly three months before this was accomplished, entailing much delay, inconvenience and some hardship on the squadrons occupying camps and quarters not ready for them.

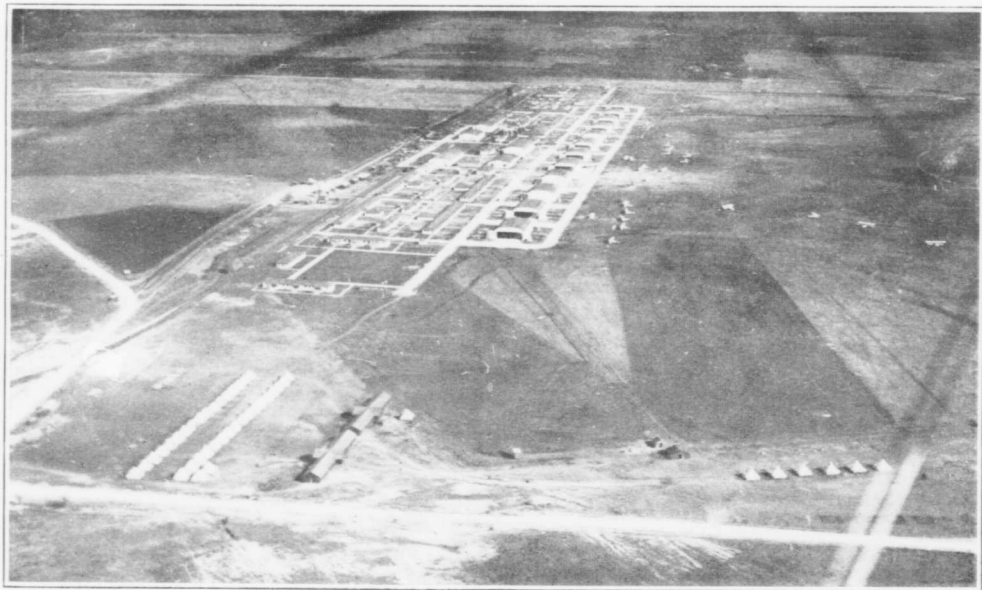
The first to arrive from Canada was the 17th Aero Squadron, U.S.S.C., which marched in to Hicks Field on October 17th. From that time on one squadron arrived weekly until November 17th when the 42nd and 43rd Wings R.F.C. and the balance of the Americans detrained, preceded only by a few days by advanced headquarters staff.

There were now in Texas two R.F.C. Wings, the 42nd at Everman and 43rd at Benbrook, the 17th, 22nd, 27th, 28th Aero Squadrons and the School of Aerial Gunnery at Hicks, advanced headquarters, R.F.C., headquarters U.S.S.C., Camp Taliaferro and the purchasing section of the I.M.B. in Fort Worth.

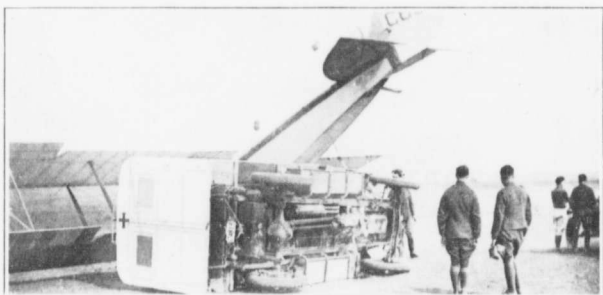
Transportation arrangements for these units from Canada to Texas were exceptionally good. The 42nd and 43rd Wings ceased flying on 14th November and recommenced in Texas on 17th November, a loss of only three days occasioned by a journey of approximately 1,600 miles.

It would not be amiss to mention the enormous amount of work thrown on A.O., A.E., and Q.M. branches through the novel situation that now existed. The U.S. owned the buildings, but the R.F.C. used and were responsible for those they occupied. There were R.F.C. squadrons and, beside them, American squadrons being trained by the R.F.C. but administered by their own authorities. Aeroplanes, engines, oil, gasoline, etc., were supplied by the U.S., but the R.F.C. directed flying, and repaired and rebuilt machines and engines, drawing the necessary spares from U.S. stores. The Aviation Department of the I.M.B. transacted R.F.C. affairs as though in Canada, and with equal facility. Cadets and men were being received continually for training, and as continually trained and returned to their own organizations. American railroads honoured transportation warrants redeemable in Ottawa. The R.F.C. medical officers quarantined the R.F.C., in which there were hundreds of Americans, against U.S. camps a few miles away. Weekly trainloads of Canadian-made engines and aeroplanes arrived, came under U.S. control and were immediately used by the R.F.C.

The situation was, in short, as though an area in Texas had been temporarily acquired by the British Empire, and in it members of an Imperial force conducted their affairs with the utmost freedom. There was friction of course—for no two great military systems can work together with all their national traditions, usages, procedures and regulations, without many minor and some major adjustments being necessary. It was, however, the friction of two keen and rival organizations pressing toward the same object. Difficulties



BENBROOK, TEXAS.



A DIVE AT "HUNGRY LIZZIE."



SALVAGE.



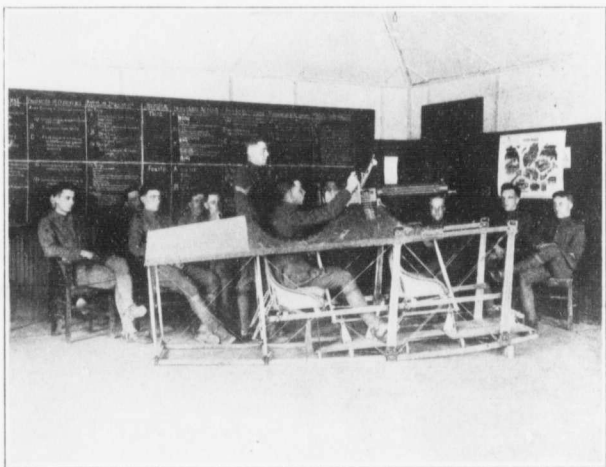
TEXAS CRASHES.



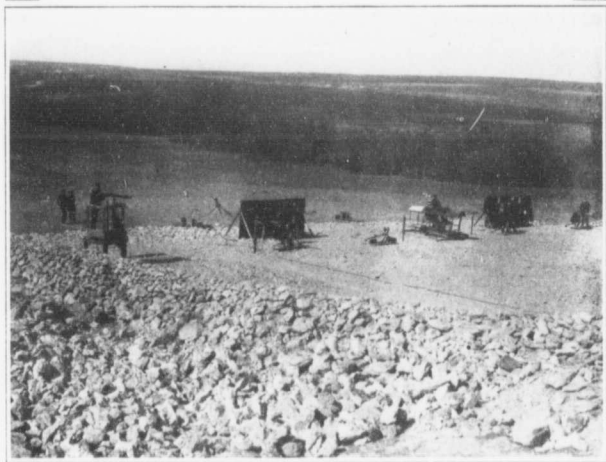
THE LOOP.



THE LOOP.



CLASS INSTRUCTION



GUNNERY IN TEXAS.

arose only to be met and overcome by the spontaneous goodwill and friendship of both services.

Before moving to Texas many American cadets had nearly finished their training. Their first flights in their own country were over aerodromes situated amid open territory with no timber and comparatively flat. Excellent material these men, the best the U.S. could supply, most of them fresh from great American universities, young, keen and quick to learn. There were very few who did not turn out excellent pilots. The supply of machines was satisfactory, the standard of flying was good, and daily acrobatics took place. Formation flying was popular. On one occasion a formation of six machines, all piloted by newly graduated cadets, were seen to loop several times consecutively, retaining their formation, a most unusual performance at that time at any aerodrome in the United States.

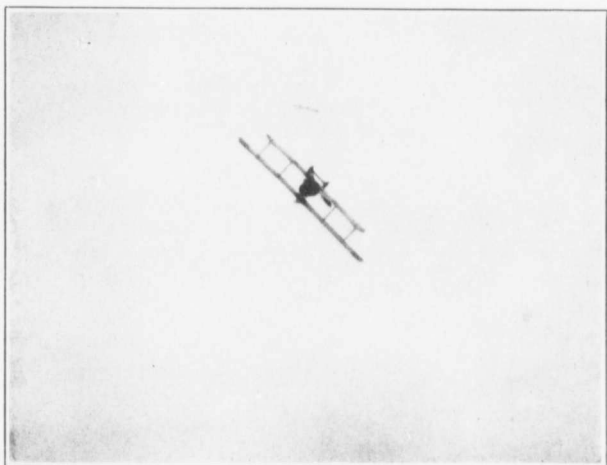
A summing up of the work in Texas shows a total of 67,000 flying hours between November 17th and April 12th, spent in turning out 1,960 pilots trained and partly trained, both U.S. and R.F.C. Besides these, 69 non-flying officers and 4,150 men were trained in their respective duties. The flying fatalities were 1.88% of pilots trained—an excellent record. The medical percentage is equally good, showing 3% incapacitated from all causes.

Flying conditions were found to differ somewhat from those in Canada. The atmosphere was much dryer and less buoyant. Calm air was the exception, despite the comparatively flat country. The temperature range was much wider, and on the arrival of a "norther," the air became chilled with extraordinary rapidity, the thermometer dropping from 70 to 20 degrees Fah. in a couple of hours. This sudden drop was more trying to many than the colder but steadier temperature of higher latitudes. Texas, though presumed a dry state, departed this winter from its

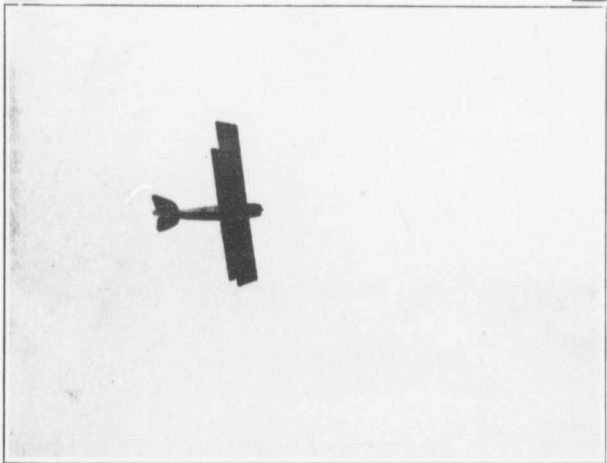
custom, and suffered heavy rainfalls and even snow, which reduced the aerodromes at times to a drab plain surfaced with a sticky blanket of mud, from which undercarriages and propellers suffered grievously at times. No less than 40 propellers were broken in one morning, and the average for one month was 10 per day. So troublesome was the mud that finally the brigade was forced to adopt the use of wire mesh mud guards. No provision had been made for sub-draining any of the fields. These periods, however, were but occasional. For the rest, the winter was one of favorable weather with high, clear skies, dotted from daylight till dark with innumerable machines.

Much admirable work was done by the personnel of both services, of which perforce no record can be given. In one instance an American squadron allotted to Hicks Field marched into new and unfinished barracks. There was no camp equipment, no water or sewerage. The hangars were congested with machines in packing cases, and there were no tools, yet within eight days the packing cases had disappeared and all machines were serviceable and ready to fly. A remarkable performance for a unit of partially-trained men.

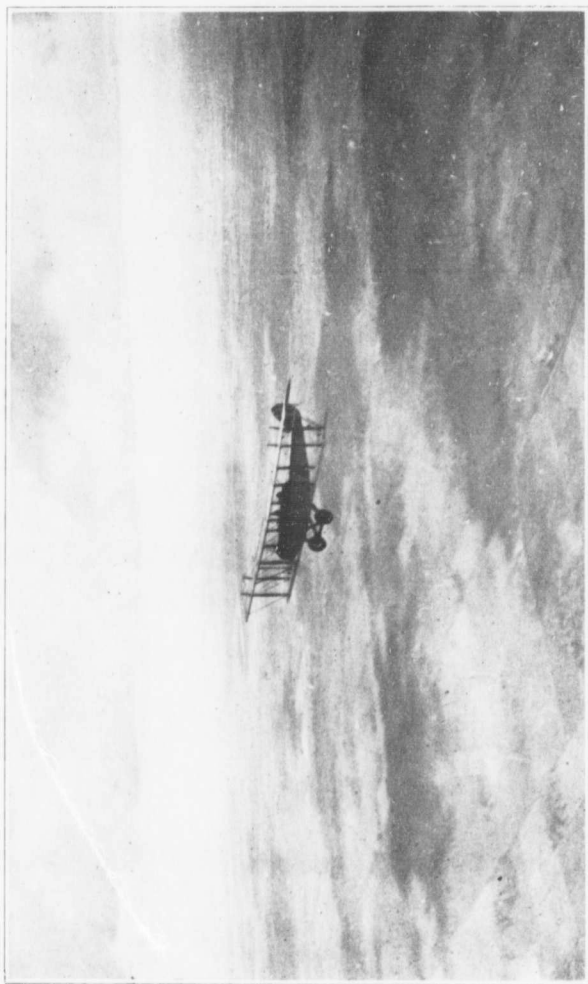
No account of the Texas experience would be complete without some record of the spontaneous hospitality and goodwill shown by the citizens of Fort Worth and the community in general. During Christmas time, pneumonia was rampant at Camp Bowie, some six miles from Fort Worth, where there were no less than 35,000 Texans, composing the Panther Division. As a result the Canadians were quarantined. This made no difference, however, to the all-hospitable Texan, who extended to officers, cadets and mechanics so many and lavish invitations that at the year's end there was not a man who had not personally experienced the goodwill of the South. The interest created by the first arrival of the brigade in strange uniforms and caps seemed to continue throughout the winter. No



"THE ROLL"—HALF-OVER.



THE "ROLL."



CALM SKIES.

Flying Corps man was allowed to walk, when every privately owned motor car was at his service. Liaison duties were most admirably discharged by the American officer who made it not only his particular duty but pleasure to see that all newcomers were welcomed under his kindly roof, and had every opportunity of meeting brother officers under the most delightful circumstances.

Fort Worth citizens subscribed the sum of \$75,000 to provide funds for the local branch of the American War Service Board, and rented a large club room and dancing hall in the centre of the city, where comfortable accommodation was found for men of both the American and British services. This organization was under the management of a "Big Brother," who seemed born to the work. Canteen and dancing halls were supervised by an organization, the Federated Ladies' Clubs of Fort Worth, in which each of the latter endeavoured to excel in hospitality, and it fell on one memorable night that the Canadians were entertained by the daughter of the President of the United States.

The Country Club was at the disposal of visiting officers, who will long remember the evenings spent in the best of fellowship. The ever-present Y.M.C.A. saw to it that commodious huts and writing rooms were furnished in all Canadian flying camps. It is impossible, in short, to imagine any source of pleasure, interest or entertainment which was not provided during these notable months in the history of the brigade.

On the evening before the departure of the R.F.C. a smoking concert was given by U.S. officers to their comrades, an entertainment which was eloquent of the comradeship born of strenuous times of mutual work, and prophetic of that still closer brotherhood which would follow in the days of active service.

The appended copy of a letter from Major-General Kenly reveals his generous appreciation of the effort of the R.F.C. personnel:—

“WAR DEPARTMENT.
“OFFICE OF THE CHIEF SIGNAL OFFICER,
“WASHINGTON.

“Air Service Division
Training Section.

“May 17, 1918.

“FROM: Chief of Air Service.

“TO: General Officer Commanding, Royal Air Force,
Toronto, Canada.

“SUBJECT: Reciprocal Agreement.

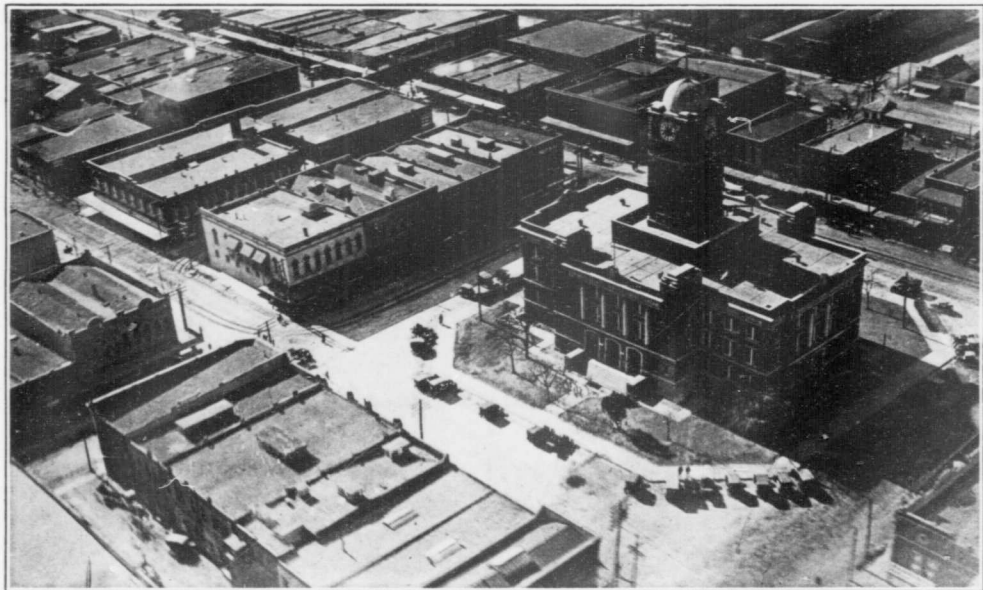
“1. The reciprocal agreement made last autumn by yourself and the Chief Signal Officer of the Army having successfully accomplished its purpose, I desire to express to you my appreciation of the manner in which the Royal Air Force, under your directions, has fulfilled its part of the arrangement.

“2. By its faithful and efficient work in the training of our cadets and enlisted personnel, the Royal Air Forces has conferred a great and practical benefit on the United States Air Service.

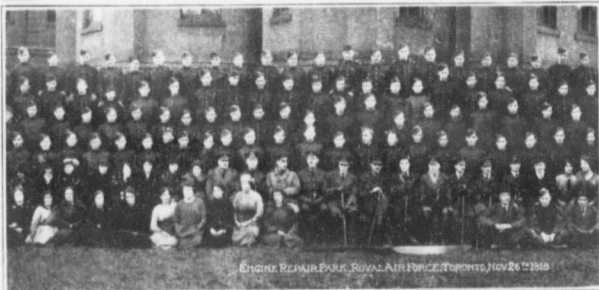
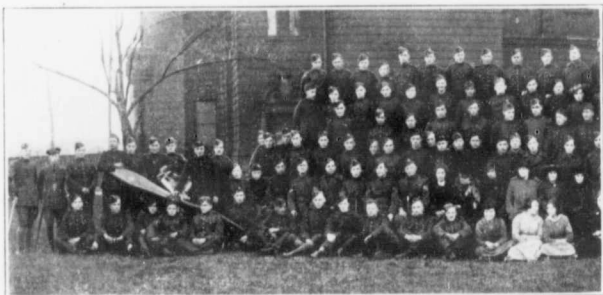
“3. Equally important is the imponderable but undoubted benefit which has accrued to our men from instruction by and association with officers and men who have had practical experience, at the front, with the conditions which we are preparing to meet. This contact, so desired by all our forces and so particularly influential in the training of a wholly new arm of the service, would, but for your assistance, have been denied to all the men training for the Air Service in this country.

“4. The following is quoted from the report of our Commanding Officer, Taliaferro Fields. ‘I am of the opinion that the reciprocal agreement between the Chief Signal Officer of the Army and the General Officer Commanding, Royal Flying Corps, has proven an entire success, and that outside of the training actually given at the fields here, the influence of the Royal Flying Corps in Texas and our association with that Corps in Canada has had a far-reaching and decidedly beneficial effect on our flying fields, throughout the United States.’ With the sentiment herein expressed I am in complete accord, and can wish no better for the United States Air Service than that it may duplicate the high endeavor and equally high accomplishment which has distinguished the Royal Flying Corps, and now distinguishes, in no less abundant measure, the Royal Air Force.

“W. L. KENLY,
“Major-General N.A.,
“Chief of the Air Service.”



PART OF FORT WORTH, TEXAS.



ENGINE REPAIR PARK, ROYAL AIR FORCE, TORONTO, NOV 26 1918



OFFICERS AND STAFF—ENGINE REPAIR PARK

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ENGINE REPAIR PARK.

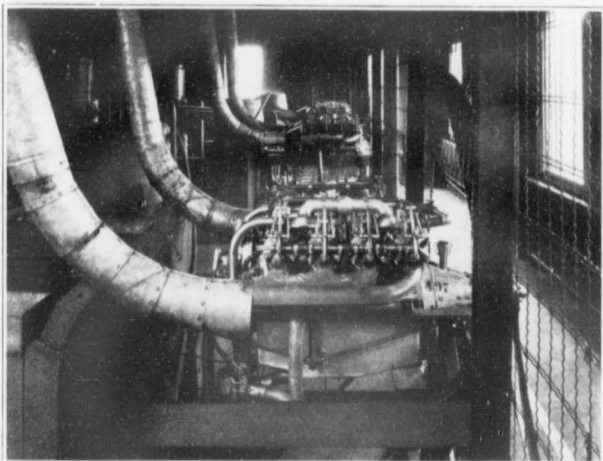
To the Engine Repair Park the brigade has looked for the main portion of that mechanical work on which so much has depended, and it has not looked in vain. The necessity for the establishment of this unit was apparent from the first, it being put into action about the time when flying might be said to have reached a permanent status. Some three months later, in August, 1917, the unit was enlarged by provision for aeroplane repair, and work of both types was done under one command. With the rapidly increasing flying hours put in by the Corps, there again appeared the necessity for still further enlargement, and the unit was finally subdivided into Engine and Aeroplane Repair. This system remained till the close of hostilities.

It is quite obvious that the mechanical condition of the power plant of an aeroplane is of paramount importance, and, in consequence, no expense or trouble was spared to put the Engine Repair Park on the best possible basis. The equipment, which in the winter of 1917, promised to be ample, soon proved insufficient, and in September, 1918, the Park moved into large and most completely fitted shops in rented premises on King Street. In this building four floors presented a scene of extreme activity, the work being so arranged as to be progressive, finishing with the final tests before shipment. During its life of some nineteen months, this Park completely overhauled no less than 1,325 engines, of which all but thirty-five were of the Curtiss 8-cylinder type. Records show that for a complete overhaul, such as was given, an average of 300 hours' work was required. The total strength of the unit in November, 1918, was 125.

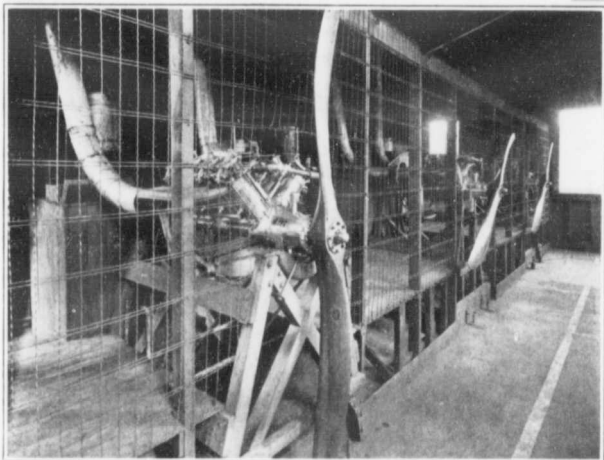
It is of interest to note that obligations covered the complete dissembling and assembling of engines, the repair sections, situated at the various wings, doing only a top overhaul, for which they were suitably equipped.

During 1918, it became apparent that considerable saving could be effected by carrying the work of the unit into the manufacture of engines as well as their repair, and, in consequence, much time and thought was given to the turning out of those integral parts which, assembled, made up the complete engine. To such a pitch was this carried that the point was reached at which only about twenty individual parts out of several hundred were purchased, the balance being the product of the Repair Park itself. It is estimated that in this way some \$30,000 was saved on the manufacture of Curtiss engines, and some \$20,000 additional when this economical system was applied to the manufacture of machine gun parts. These estimates of saving are probably low, owing to the fact that 50c. an hour was allowed for bench work and \$1.00 an hour for machine work.

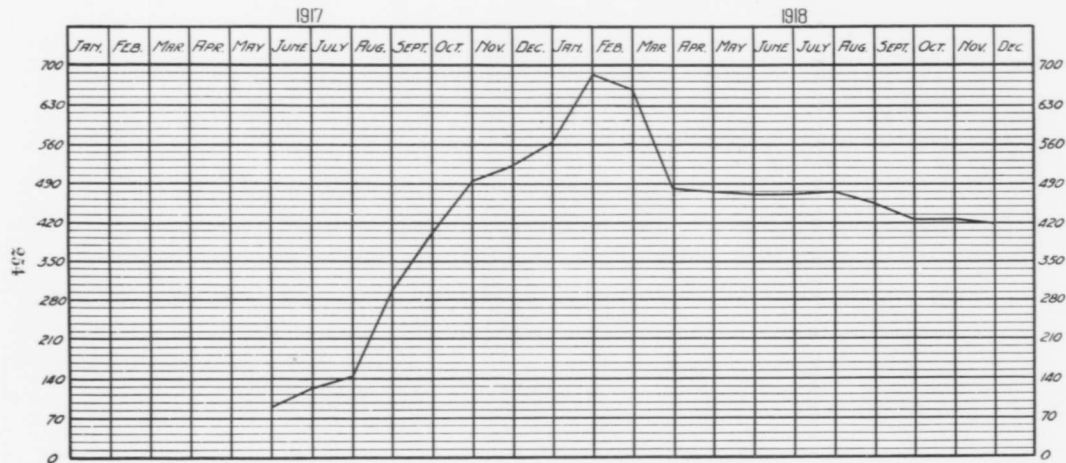
The rarity of any serious engine trouble reported by the flying wings, is a tribute not only to the admirably simple design of the Curtiss engine, but also to the excellent work done by the Engine Repair Park.



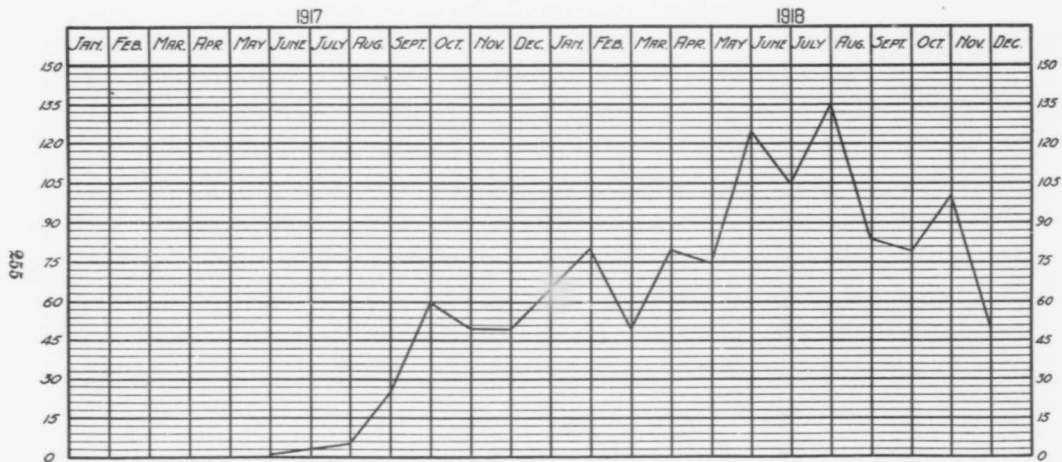
ENGINES MOUNTED FOR TEST.



THE STARTING END,
(NOTE PROTECTIVE SCREEN).



R.A.F. CAN.-MONTHLY STRENGTH OF ENGINE REPAIR PARK



R. A. F. CAN-ENGINE REPAIR PARK-ENGINES OVERHAULED AND SHIPPED PER MONTH

AEROPLANE REPAIR PARK.

This unit commenced operations as a separate organization on the 23rd February, 1918, prior to which time both engine and aeroplane repairs were made under the same administration. The work consisted of not only rebuilding every machine which crashed, but also dismantling and reassembling every aeroplane which had completed its flying time at the various wings. The fact that 400 hours in the air was considered to necessitate complete rebuilding, will indicate the extreme care taken to ensure that no instructor or cadet took to the air in an aeroplane which was not in perfect mechanical condition.

Entire dismantling was accomplished in every case, and after every individual fitting and part had undergone various stages of repair and inspection, it was sent forthwith to the technical stores, whence it was reissued as required for construction of new machines. By this means it was found feasible to salvage and re-use not less than sixty per cent. of the members and fittings of every machine received by the unit.

In the early summer of 1918, the output of the Aeroplane Repair Park (the quality of this output being always entirely satisfactory) reached such a point that the brigade found it unnecessary to continue the practice of buying complete machines from the Canadian Aeroplanes Limited, and the latter undertook to supply only such individual parts as the Repair Park was not equipped to make for itself. Thus this organization proved its constantly increasing importance.

A glance at the exterior of a machine gives no idea whatever of the number of integral parts which go to make up a structure seemingly so simple, and the fact that the parts are so numerous threw additional

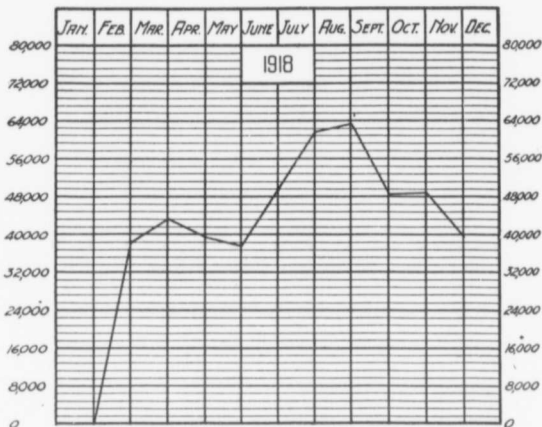
work on the stores section, which was required at all times to keep in stock an ample supply of members and fittings.

In addition to the work of salvaging machines, the unit had other duties to perform, such as the repair of instruments, tires, inner-tubes, radiators, metal fittings, wings, etc. The aeroplane when dismantled presents a vastly different appearance to that of the complete machine ready to take the air.

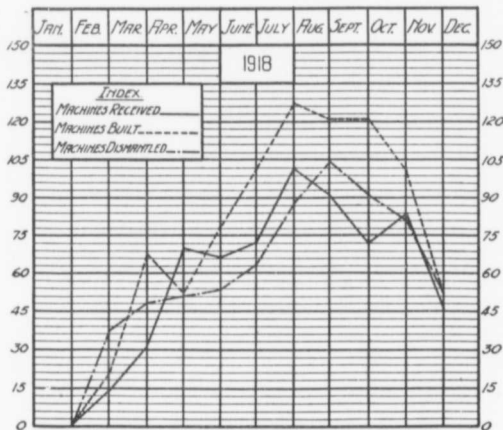
In all construction the progressive system was worked out, by which machines, commencing at the first stage, moved on from section to section, receiving at each point the necessary additional touches, till at the end they emerged mechanically complete. The work was, in fact exactly like that at the Canadian Aeroplanes Limited, with the exception that in addition to new construction this unit shouldered as well the system of salvaging, by which great economies were without question effected. Over and above this, there went out from the Repair Park a constantly increasing flow of wooden members, which were absorbed by various flying units in repairs made on wings and ailerons at these stations.

Two graphs, given herewith, show the fluctuation in the quantity of work done, this fluctuation corresponding with demands made. These will be found to synchronize closely with other data giving the record of crashes, etc.

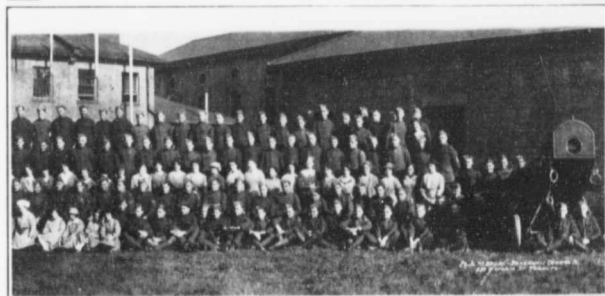
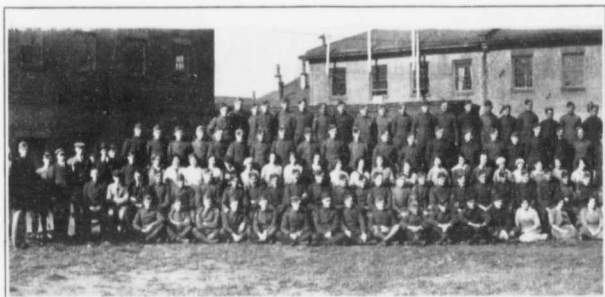
In a retrospection of the general operations of the brigade it has been impossible to find a scene of operations better organized than this Repair Park, or one of which the output was more uniformly dependable and mechanically satisfactory.



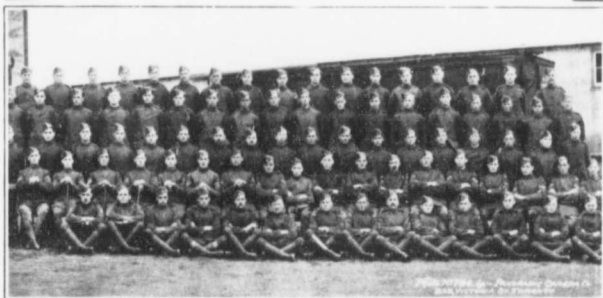
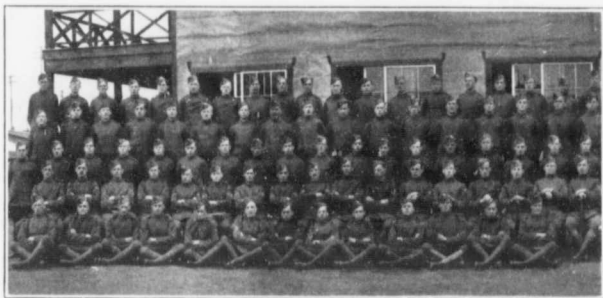
MAN HOUR PRODUCTION



MACHINES PASSED THROUGH
RAF C.A.R. - AEROPLANE REPAIR PARK



OFFICERS AND STAFF—AEROPLANE REPAIR PARK.



OFFICERS AND STAFF—STORES DEPOT.

STORES DEPOT.

Stores Depot has been the general receiving, distributing and clearing house for all supplies and equipment used by the brigade, and it is estimated that between 20,000 and 30,000 different types of articles and appliances have been carried in its spacious premises.

Provision of this organization was recognized as an imperative necessity at the very inception of the Corps. Its procedure has been from the start greatly assisted by the fact that the Aviation Department of the Imperial Munitions Board has acted as purchasing agent, and has always placed its unique facilities at the service of the R.A.F. and secured for the latter the very best possible terms and deliveries procurable. In order to reduce as far as possible the labor imposed upon the Imperial Munitions Board, the requirements of each unit for a definite length of time were estimated, grouped and submitted as one request. It will be understood that these requirements covered all needs from socks to propellers. This procedure is termed "provisioning."

Purchased material, being received at Stores Depot, is subject to a minute inspection, and no payments are made by the Munitions Board until notification has been received from the inspection department that the articles received are in classification and quantity exactly what has been ordered. If this centralizing of receiving work should be considered in any way unnecessary, it has only to be pointed out that the receipt of purchased material is thereby enormously simplified, and the duty of inspection is unified in one specially qualified organization.

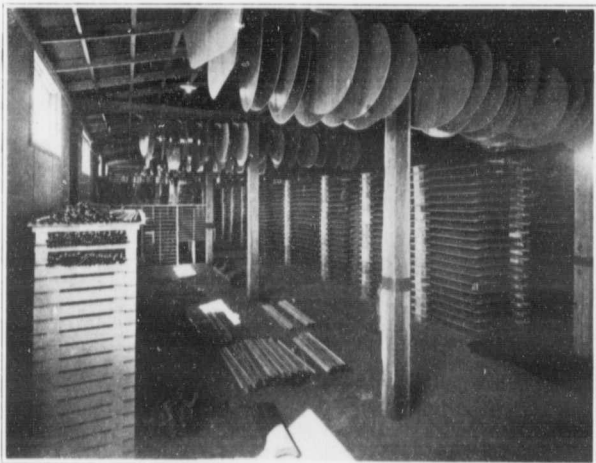
It is easily seen that without extreme care Stores Depot might have accumulated an enormous quantity of innumerable articles, quantities far beyond actual requirements of the various units for whom they were

purchased. In consequence, the practice has invariably been to compile a schedule covering the needs for six months of each branch of the service, and confine the stocks carried to these amounts.

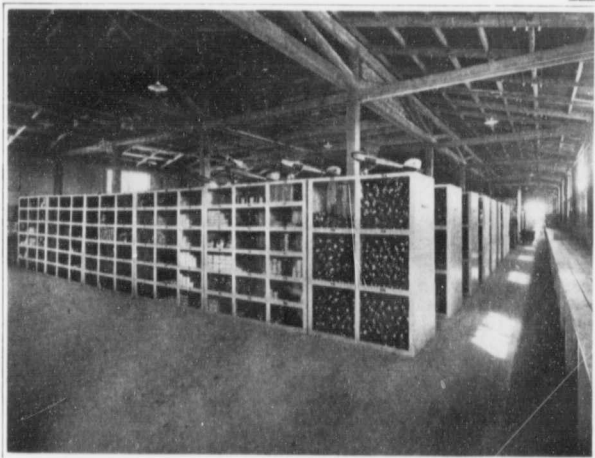
The amount of work discharged by Stores Depot has been probably not thoroughly appreciated, even by the various branches of the brigade. Records show an average receipt per week for the last year of some 250 shipments, or between thirty or forty a day. These shipments range from one case to seventy or eighty cases each, while from the commencement of Stores to November, 1918, there have been placed with the Aviation Department of the Imperial Munitions Board some 9,000 requisitions, each of which represents an average of ten different types of articles, each requisition in turn has been covered by from one to ten orders placed by the Munitions Board, while every order has been covered by from one up to as high as one hundred invoices.

The responsibility of Stores Depot has involved not only receipt and distribution of all supplies required by the brigade, but also the maintenance of a form of record which will enable the government auditors to trace the entire history of any article which has passed through this organization, from the date of the order given for its purchase up to the point at which it has reached the end of its serviceable life and been written off.

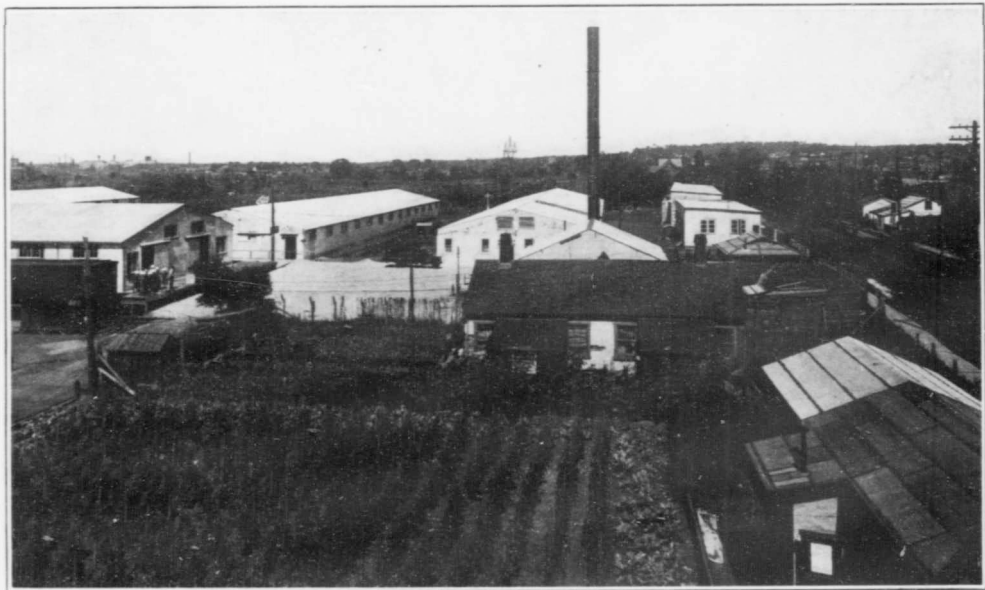
It will, of course, be understood that supplies have been sent to the various wings only upon a request being made by the latter, and it is furthermore necessary that the type and amount of the equipment which is being asked for coincide with the provision Stores Depot are authorized to make, and the rate of consumption which is laid down as being proper for the particular service involved. If, on the other hand, any purchase is necessary of articles not carried as standard, special authority is required to be granted before action is taken.



WINGS AND RUDDERS. ✓



SPARES. ✓



PART OF STORES DEPOT.

The move to Texas of a section of the Corps in October, 1917, and the return of that section to Canada in April, 1918, threw additional responsibility on Stores Depot organization, and shipments which involved as many as twenty carloads per day were frequently sent out, the total value of articles thus forwarded being over \$2,000,000. It was also of extreme importance that on the return of the Aerial Gunnery School to its permanent quarters at Beamsville, this unit should find itself equipped with the involved and often highly technical scheduled supplies required for its special duty, and it is to be recorded that this provision was admirably foreseen and supplied.

In the Stores Depot, as well as in all other units, excellent service has been rendered by lady civilian subordinates, and in October no less than 184 were on the strength of this unit. There was required, of course, the special training of those hitherto unskilled in these particular duties, but the result has amply justified the trouble taken. Over and above the civilian subordinates, there were on the strength 17 officers and 217 other ranks. All have contributed to a notable degree to the success of the work of other units, which without a constant dependable supply of necessary equipment would have been soon rendered ineffective.

THE PAY OFFICE.

The Pay Officer arrived in Canada on the 11th February, 1917, with four non-commissioned officers of the Imperial Army Pay Corps and eight boxes of army books and forms, the latter, however, being practically useless. Canadian conditions were vastly different from those in England.

A suitable office was located at 20 Victoria Street. The Pay Officer then immediately notified the press of his arrival and address, and work began on February 17th, necessary funds being drawn from the War Office through the British Remount Commission in Montreal.

Owing to values in Canada varying widely from those prevailing in England, it was essential to tread very warily regarding the fixing of rates of pay and allowances and innumerable other points known only to those who have experience in an Army Pay Office.

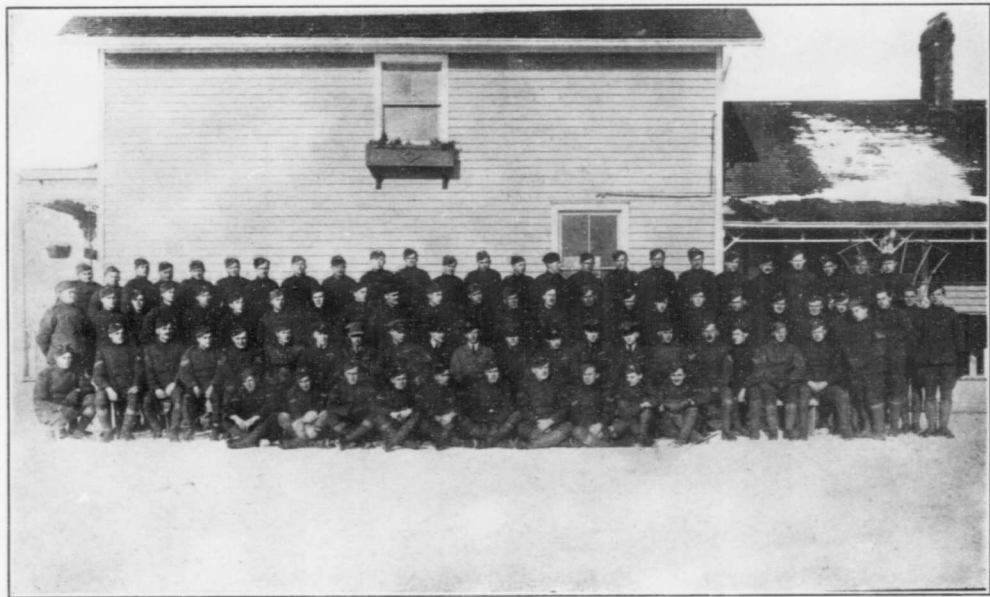
Once in the swing, and after numerous conferences and interviews with Imperial and Canadian authorities, the department became a hive of industry. Its extraordinary growth may be seen from the following table:

Month	Total Cash expended on all services	Total Cash issued to Sub-accountants	No. of Sub- accountants	No. of cheques issued
February, 1917.	\$ 2,000.00	\$ 1,500.00	2	26
July, 1917	236,572.90	152,812.14	19	1354
January, 1918.	588,610.97	375,164.47	19	2926
July, 1918.	782,383.76	469,291.57	18	4036

The number of claims for separation allowance to wives of cadets, warrant officers and other ranks paid in February, 1917, was fifteen. At present 1,579 claims are issued every month. Similarly the pay-



PAY OFFICE STAFF



90TH SQUADRON, CAMP RATHBUN

ments to dependents have increased during the same period from 2 to 1,684. The expenditure incurred for the above services to the end of November, 1918, is approximately \$1,200,000.

The total number of cadets, warrant officers, non-commissioned officers and airmen who have been dealt with through the Department has reached the total of 18,232.

The total expenditure by the Pay Officer on all services from February, 1917, to December 31, 1918, has been \$12,555,000.

For the reader's further information, all units hold sub-accounts with the Pay Officer for the payment of their personnel, each sub-accountant rendering a monthly statement, properly vouched, to show how the money advanced has been disposed of.

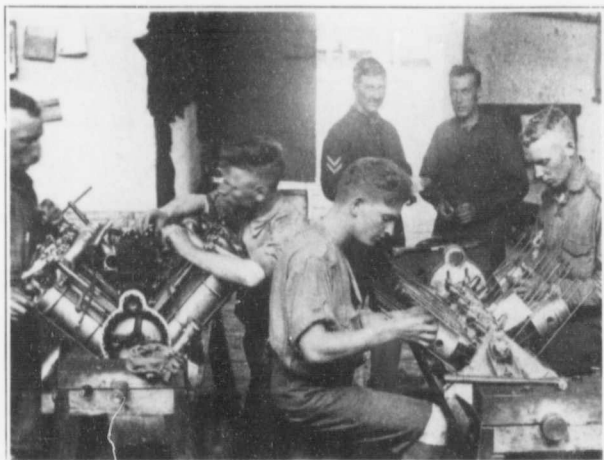
The Pay Officer's further duties involve also the keeping of each man's account on a ledger sheet, showing clearly by monthly periods the credits due and the debits made against each account. In addition, a ledger account is kept of the amounts due and paid to the wives and dependents of airmen. The Pay Office also assumes the payment and examination of all railway warrants, and all rations in kind issued to all ranks. This includes the adjustment between the Imperial and U.S. Governments for rations and supplies issued in Canada and Texas under the reciprocal training agreement. The examination and payment of all accounts from civilian authorities for damage to private property on account of crashes and breakdowns of aircraft and mechanical transport falls to this department.

The Victory Loan of 1917, was by arrangement with the Pay Officer, inasfar as the R.A.F. was concerned, paid for by instalments through allotment from the men's accounts. The total of \$350,000 was subscribed in this manner.

As to the staff, one officer and four non-commissioned officers were responsible for the training of an ever-increasing personnel, and the effort was made to utilize each man's civilian experience to the utmost. Bank clerks and accountants who enlisted into the R.A.F. were, upon request, usually allotted for duty with this department, thus ensuring efficient ground work. Each was thoroughly schooled, promotion by merit being the incentive. This practice has always been adhered to, and has been found most satisfactory. The total of men clerks is now 38, in charge of a flight clerk. There are but two officers.

The female subordinates were mostly obtained from the public schools and colleges, and, after training, their work has been as duly recognized as that of the men. Most have been with the department for more than twelve months. This speaks well for their work and efficiency. The female staff numbers 41, with one lady superintendent in charge.

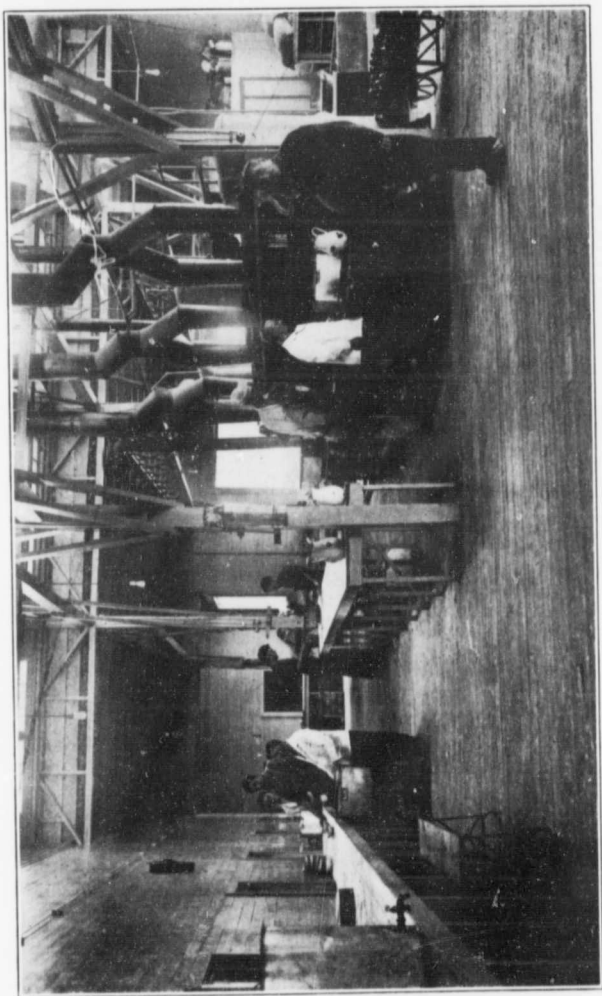
It is desired in conclusion to point out that the demobilization of the Force in Canada has seriously taxed the efforts of this office, but, taking past experience as a guide, no trouble is being experienced in disposing of the tremendous detail involved in returning the corps to civil life.



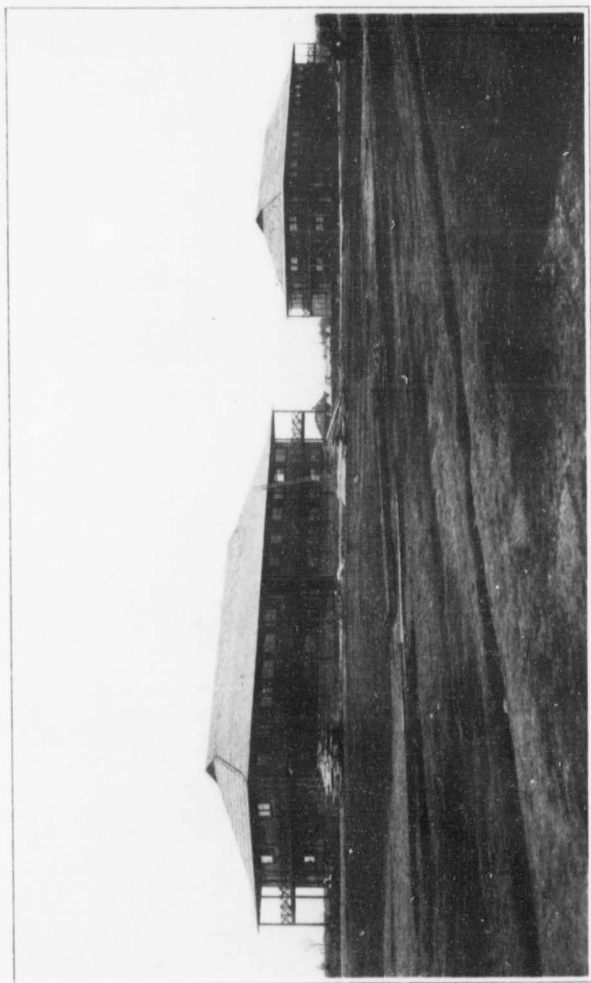
TOP OVERHAUL.



TOP OVERHAUL.



MEN'S KITCHEN—CAMP BORDEN.



CADET BARRACK BLOCKS—LONG BRANCH.



MECHANICAL TRANSPORT SECTION.

MECHANICAL TRANSPORT SECTION.

This organization came into official existence on March, 17th, 1917, with a strength of one officer, fifteen non-commissioned officers and airmen, and some fifteen vehicles which had been brought out from England by the advance party of the wing.

By October, 1918, the number of vehicles had grown to about 400 (exclusive of side cars) these being looked after by a staff of some two hundred and thirty non-commissioned officers and airmen, thirty lady drivers, and a clerical staff of thirty-six. The vehicles were distributed throughout the various sections of the brigade, all major sections being so organized as to make their own repairs without reference to the central establishment in Toronto.

Housed at first in rented premises in the Wolseley Garage, Toronto, the headquarters establishment was moved early in August, 1917, to its new building in Dupont Street. This structure was approximately 180 ft. x 150 ft., being laid out in bays, and so arranged as to afford both the maximum storage space and the best possible accommodation for repair work. The latter in turn was subdivided into branches, each taking over its special duty as applied to various features of repair work, thus ensuring that a car which came in for overhaul moved constantly forward until, on completion, it had passed through the hands of every section concerned. Arrangements were so perfected that a complete overhaul could be completed by noon on the third day from commencement, and three days later the vehicle, completely painted and varnished, stood ready for either storage or reissue.

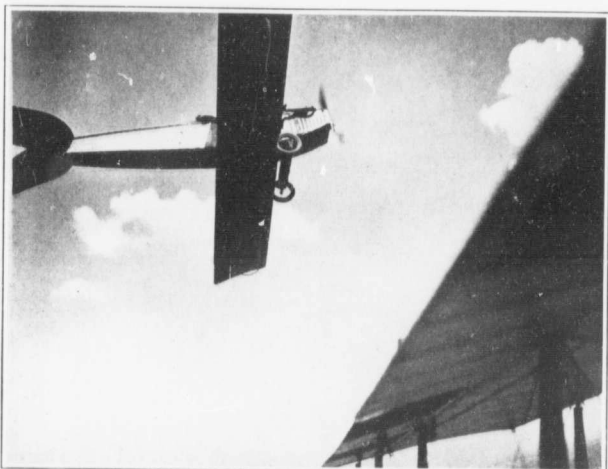
The salvage of spare or worn parts proved, of course, to be a point demanding special attention, inasmuch as a great portion of the expense connected with overhaul is invariably to be found in such replacements.

Under the arrangements made, all worn parts were classified and, wherever possible, repaired and stored so as to be ready for re-issue when needed. It is reported by the officer in charge of this section that the average repair output per week was some nineteen vehicles of all descriptions, heavy and light, this work being accomplished in addition to maintenance, washing, etc., of all the other vehicles in the headquarters section.

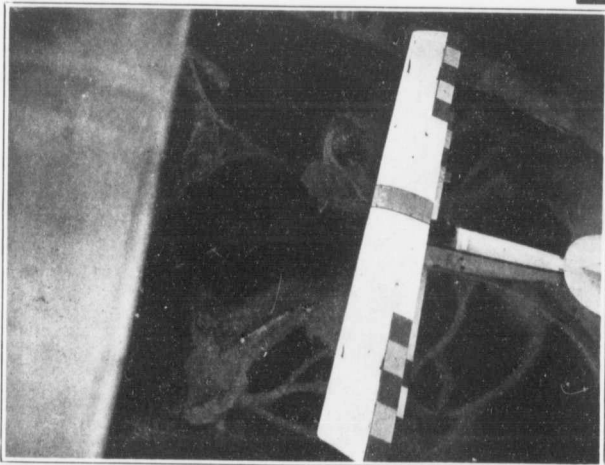
The transport purchased locally proved most efficient, and in the Toronto section 1,200-miles-run was averaged per day. Every vehicle carried a log book, in which its duty was carefully detailed, and all vehicles were completely rebuilt twice a year.

In October, 1918, the section, again expanding, occupied large premises on Avenue Road, reserving the former building for repair work only. The duties of various units of the brigade called for transportation work of a widely varying nature, so it came that the fleet of official vehicles presented an extreme variety, ranging from Packard ambulances—admirable vehicles specially constructed for hospital work at high speed over rough ground—to repair lorries and motorcycles. Gasoline tanks for service on aerodrome, proved invaluable, and fire protection was distinctly aided by the purchase of chemical trucks which were stationed at various units.

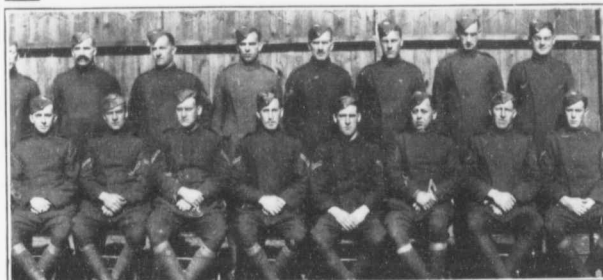
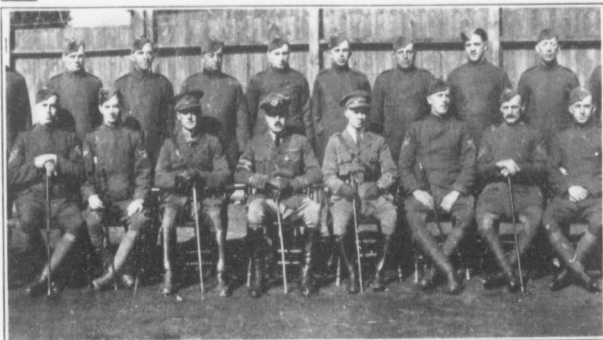
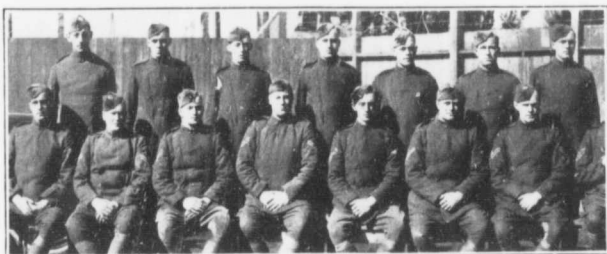
The work of the section was extended to the carrying of local mails between the various units in Toronto. This proved to be most advantageous. No record of the section would, furthermore, be complete without some reference to the duties performed by the lady drivers who patriotically volunteered for this service. Their history is one of entire success, both as to the duty performed collectively and individually, and also having in view the all-important fact that by the acceptance of service so finely offered the brigade was able to release many men for other and imperative work in all sections of its operations.



IN FORMATION. ✓



A SNAPSHOT. ✓



ASSISTANT PROVOST-MARSHAL, OFFICERS AND STAFF

THE ASSISTANT PROVOST MARSHAL

An Assistant Provost Marshal was appointed on February 1st, 1918. This was deemed advisable owing to the large number of men enlisted in the Royal Air Force, Canada. It further relieved the Canadian Military Police Corps of the extra work of supervising airmen in the streets of Toronto.

On the formation of this office there were approximately thirty enlisted men to carry out the duties of Royal Air Force policemen. The number has since been increased to fifty, whose duties consist of patrolling the streets of Toronto, and generally supervising the discipline and movements of airmen when on leave in the city. They have also carried out all necessary escort duties in bringing absentees back to their units.

A city guard room was opened in April, 1918, situated at the corner of Church and Wellington Streets, and later moved to the basement of the Records building, at the corner of Duke and George Streets.

In July, 1918, the Royal Air Force detention rooms and police barracks were opened at 1322 Dufferin Street, for the dual purpose of receiving airmen sentenced to undergo detention and to accommodate the personnel of the Assistant Provost Marshal's staff. These barracks are under the supervision of an officer specially detailed for the duty.

Since July of 1918, three men have been continually on duty in New York City, under the direction of an officer of the Royal Air Force, to supervise the discipline of airmen when on leave in that city.

In the above connection it will be seen that considering the many thousands of men on the strength of the brigade, the staff of the A.P.M. was extremely small. No better evidence could be given of the excellent discipline and behavior of the Force.

ROYAL ENGINEERS' SECTION.

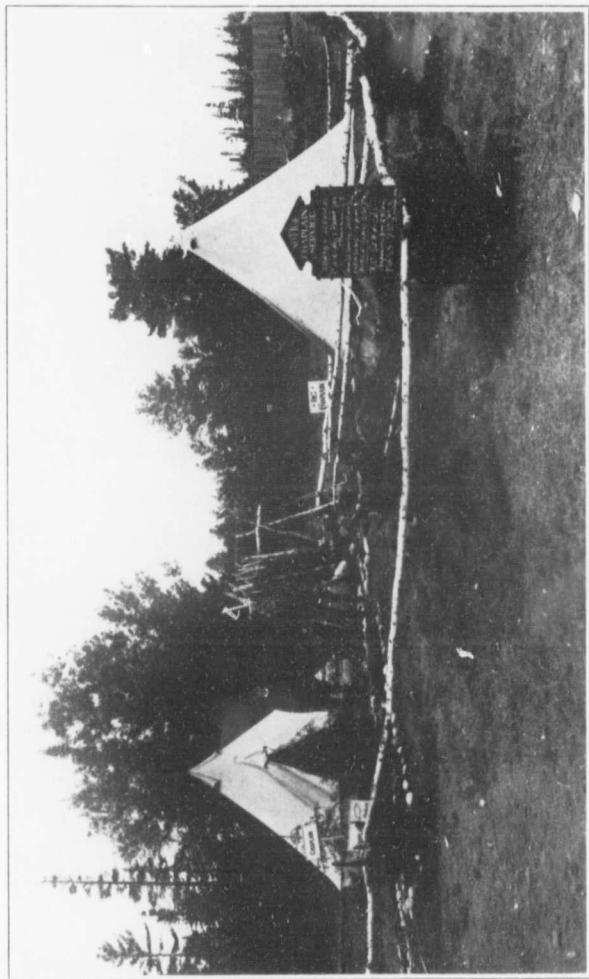
Early in 1917 two engineer officers were appointed to the staff of the Officer Commanding, R.F.C., Canada, for technical duty in the selection of aerodrome sites and construction work generally. The former occupied the initial period of their service, but with the enlargement of the Corps came the necessity of a Royal Engineers section to deal with affairs of maintenance and repair. It was considered that the best results would be secured by posting detachments of this unit to various stations, etc., to which, under an R.E. non-commissioned officer, they were attached for discipline, pay, rations, etc.

Under these arrangements, the R.E. section carried out its obligations until the end of August, 1918, when on account of the shortage of men who were both of military age and of required trades, it was decided that the maintenance work performed up to this time by the various subdivisions of the R.E. section, should be taken over by the construction section of the Aviation Department of the Imperial Munitions Board.

The method of carrying out maintenance work was thus changed, but the responsibility for inspection and general supervision still devolved upon the headquarters branch of the R.E. section. The strength of the latter was reduced from an authorized establishment of 135 to a staff of four officers, four or five draughtsmen and a sufficient number of clerks. The duty performed by the unit still covered, as before, the general design of all buildings whether technical, instructional or barracks, coöperation with the construction section of the Munitions Board in the securing of service of water, power, light, etc., and, in general, such responsibilities as fall upon a firm of consulting engineers. To these must be added the fact that this section was responsible



OFFICERS AND STAFF, ROYAL ENGINEERS' SECTION.



"CHURCH UNION" AT CAMP BORDEN.

to the General Officer Commanding, and acted as technical go-between and adviser between him and the Munitions Board in all constructional and in many technical matters.

In retrospect it appears that the arrangement worked exceedingly well. The coöperation of the Munitions Board relieved the unit of all except very minor construction. During the period of this coöperation, some 400 buildings were specially erected by the former, some 40 other existing buildings altered and fitted, together with the provision of innumerable services of varied nature. Records show the completion of six aerodromes with accommodation for 22 squadrons, and the establishment of an Armament School at Hamilton and a Cadet Wing at Long Branch. The average cost for barrack accommodation was approximately \$235 per man. In this connection it is interesting to note that at a time when men were becoming extremely scarce owing to the annulment of transfer from R.F.C. to the R.A.F., the employment and accommodation of women on a fairly large scale was discussed. Analysis of building costs showed that barrack accommodation would in this case cost some \$430 per head, owing to the necessity of special provision. The scheme was not unnaturally abandoned.

CAMP BORDEN.

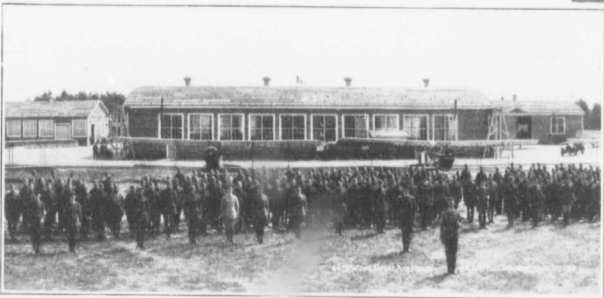
This camp, the summer home of the 44th Wing for the year 1918, represented the first structural activities of the unit in Canada. By most energetic methods it was transformed from a sandy desert, and became probably the finest flying camp in North America, the Department of Militia and Defence having put at the disposition of the unit approximately 1,000 acres adjoining the C.E.F. camp of a similar name. The work of construction, which began at the end of January, 1917, progressed so fast that flying began early in April.

Never probably in the history of Canadian construction has a scene of greater activity been presented than was observed at Borden during this period under the direction of the late Colonel Low, backed up by an R. E. officer lent by the Department of Militia and Defence. Work progressed unceasingly in a temperature often 20° to 30° below zero. Buildings sprang up at night under the glare of arc lamps, and physical difficulties one after the other were met only to be conquered. Within two weeks 1,700 men and 200 teams had been transported and were at work.

Hundreds of acres of sandy soil were sown with grass seed, thousands of stumps were uprooted and numberless hillocks levelled. An excellent road system, a first rate water supply and electrical system were all provided, together with special telephone communication to Toronto and neighboring towns.

The type of building adopted was retained for all subsequent construction, and has proved to give a maximum of comfort with a minimum of expense.

At the close of hostilities, Camp Borden had accommodation for 122 officers, 500 cadets, 120 warrant officers and sergeants, and 900 rank and file. A few



OFFICERS AND STRENGTH, 44TH WING, CAMP BORDEN.



OFFICERS, 44TH WING, CAMP BORDEN.

illustrations of typical buildings are given, together with photographs of the strength at the cessation of hostilities.

The surrounding country is level, and affords many opportunities for landing. To the north stretches the great expanse of Lake Huron, to the east lies Lake Simcoe, and 50 miles to the south is the shore of Lake Ontario. To those who visited Borden when the air was full of machines, there has always been something peculiarly fascinating in the wide, clear skies and unquestionable atmosphere of space and height which is noticeable.

During its occupancy, the 44th Wing did much to improve the camp, and the energetic measures taken by the officer commanding for the comfort and enjoyment of his unit will long be remembered. A large concrete swimming pool, 100 feet by 40 feet was built, a cement tennis court of exceptional excellence was constructed, and a golf course of 9 holes laid down by first rate professionals, arrangements being made whereby, for the expenditure of a few cents, all could enjoy this most inviting of sports. Games, football and all types of physical exercise were indulged in, and it was impossible to find within the boundaries of the corps a more complete programme of physical relaxation.

The chart on page 291 shows the number of cadets passed through this wing. It should be remembered, however, that until the formation of the School of Aerial Gunnery in April, 1918, at Beamsville, the 44th Wing assumed this instruction. The unit occupied Camps Leaside and Armour Heights during the summer and winter of 1917, but for the rest of its active history its home has been at Camp Borden.

LONG BRANCH.

At first the scene of the initial flying activity of the brigade, i.e., that of "X" and "Y" Squadrons, Long Branch subsequently became the home of the Cadet Wing. The area covers approximately 100 acres, its use being kindly granted by the Department of Militia and Defence.

During the summer of 1917, cadets were housed under canvas. When autumn came, the unit was split between camps Mohawk and Borden, then vacated by units proceeding to Texas, and returned in April to a larger tented city on the former ground. During the summer of 1918 it was decided that permanent accommodation be provided, this being due to the fact that it was not contemplated that the brigade should again visit Texas. By the autumn most excellent provision had been made for 30 officers, 1,200 cadets, 68 warrant officers and sergeants and 1,200 rank and file.

The camp is excellently laid out, supplied with power and light from the transmission lines of the Hydro-Electric Power Commission, and was complete with every provision for the instruction, comfort and amusement of the large number of cadets on the strength.

Hospital accommodation at this unit was especially centralized, and arrangements provided that technical instruction be given to patients so far as their condition permitted. The Cadet Wing was always prominent in sports, and during the summer of 1918 several racing shells were purchased and afforded much enjoyment along the shores of Lake Ontario, which lies immediately on the south boundary of the camp. Here also constant interest was occasioned by the passage of machines en route to the School of Aerial Fighting at Beamsville.

DESERONTO.

The Town of Deseronto is on the north shore of Lake Ontario, some 130 miles east of Toronto. Between it and the main body of the lake, lies the island county of Prince Edward. Here, at points three miles west and one and a half miles north, were selected the two aerodromes of camps Mohawk and Rathbun, the former being part of an Indian reserve, the use of which was secured through the agency of the Department of Indian Affairs at Ottawa, the latter being a level farm owned by a prominent family in the town of Deseronto. Work commenced during April, 1917, and was sufficiently far advanced to enable machines to take the air in the following month.

The technical equipment at Mohawk ultimately consisted of twelve flight sheds (four squadrons), with complete provision for aeroplane repair and ground instruction, the engine repair work being done in rented sheds in the town of Deseronto. The aerodrome itself was unusually level and the surrounding country fairly open. A large amount of flying took place, of course, over water. Within easy reach to the eastward lies that exquisite expanse of the St. Lawrence River which encircles the Thousand Islands.

The camp buildings, centrally heated, crowned an eminence lying between the aerodrome and the water's edge, a beautiful site which commanded an excellent view of the adjacent country. Mohawk, with the neighboring camp of Rathbun, was occupied during the early summer of 1917 by the 43rd Wing, headquarters administration being housed in the Town of Deseronto, from which both camps could easily be reached.

The development of training, confined at first to aerial work, was carried to the point of giving ground and gunnery instruction, and an excellent range was

constructed near the barrack buildings. Water was drawn from the lake nearby and chlorinated for use, while ample electrical facilities were secured from the transmission circuits of the Provincial Hydro-Electric system.

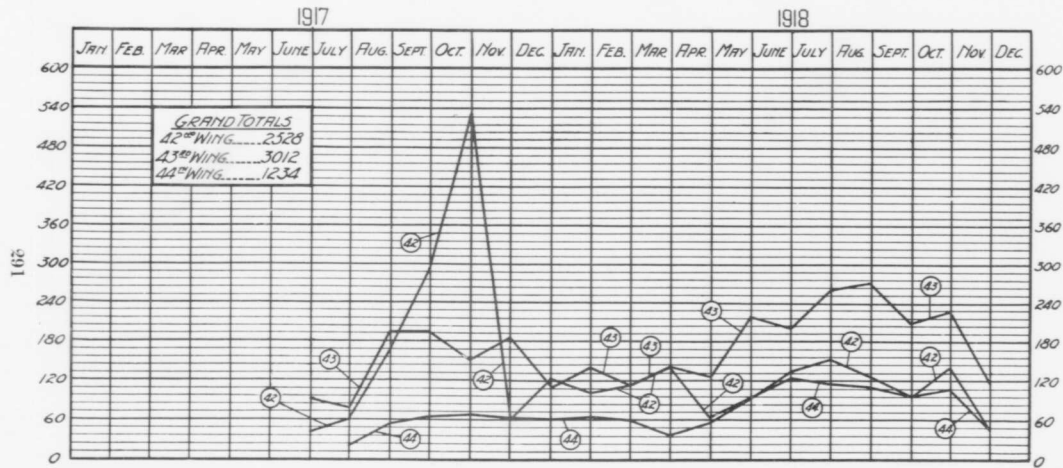
By November, 1918, the accommodation of this unit was sufficient for 71 officers, 320 cadets, 69 warrant officers and sergeants, and 450 rank and file.

Camp Rathbun, one and a half miles north of Deseronto, was topographically very similar to Mohawk, but comprised a lesser acreage. During the autumn of 1918, the accommodation there was also increased, and a central heating plant erected in order to keep all buildings thoroughly comfortable during the winter months. There was provision for 53 officers, 246 cadets, and 330 other ranks. Water was chlorinated and drawn through the municipal system of the town of Deseronto, and electrical energy secured as at Mohawk.

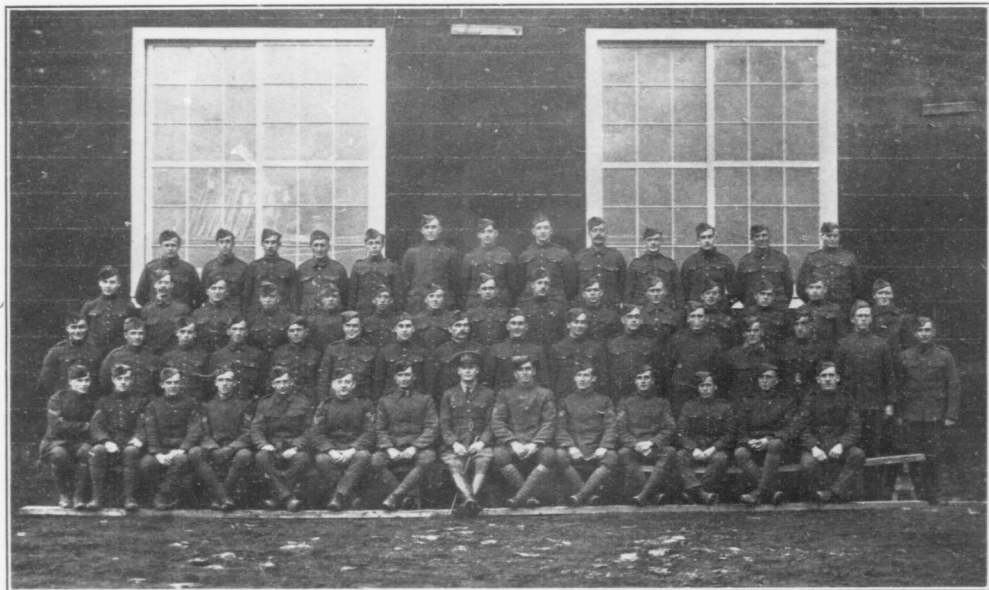
Both the above camps were occupied by the 43rd Wing during the summer of 1917, and by the 42nd Wing during the summer of 1918. In the intervening winter, Camp Mohawk afforded accommodation for one half of the Cadet Wing held in Canada in training during that particular period.

Wing headquarters have always been in Deseronto, and there also, during the summer of 1918, permanent housing was erected for that section of the occupying wing engaged in repair, motor transport and similar work. Here too was housed the headquarters staff.

Women civilian subordinates were largely employed at Deseronto, making their temporary homes in the town, and radiating out to the two flying camps. In spite of apparent scanty accommodation the arrangement worked here, as elsewhere, to the definite advantage of the Corps.



R.A.F. CAN.-OUTPUT OF CADETS-42ND, 43RD, & 44TH WINGS



REPAIR SECTION—CAMP MOHAWK.

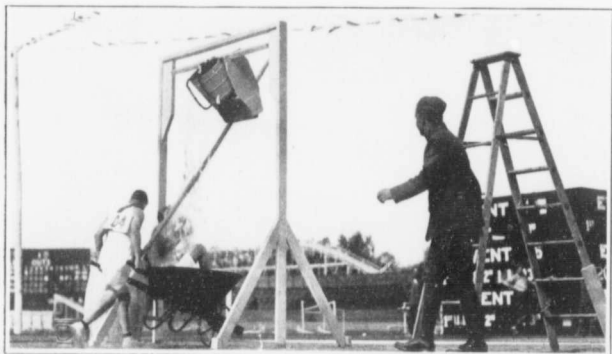
Telephone communication connected all units, and a private wire was secured between wing headquarters and headquarters in Toronto. The Canadian Northern Railway immediately serves the town, and the Grand Trunk Railway Company's lines pass within the short distance of seven miles, and were very frequently used. The roads in the camps' vicinity have been considerably improved by the Corps. A noticeable increase in the commercial life of the community has taken place since this section of the brigade took up its residence.

SPORTS.

The instructions of the Air Ministry that sports should be encouraged in all possible forms, met with the keenest approval from all members of the Force, and as a result great advantage was secured in keeping the physical condition of all ranks at the highest possible point. During its first year's history the Corps was in the throes of organization, and with the exception of individual sports meetings held at various stations, there was no possibility of organizing any general system. A representative football team was, however, formed in March of 1917, which, playing in the Ontario Provincial League, had by the end of the season won a silver trophy known as the Shamrock Cup, together with a gold medal for each player, and, as a finale, journeyed to Montreal and defeated the well known Grand Trunk Railway Team by 3 goals to 0, after a hard fought game.

Hockey presented too much of a problem to be faced during the first winter, owing to the fact that there were not at the disposal of the various units sufficient rinks of the required dimensions. On the removal of part of the unit to Texas, however, the question of sports was definitely taken up, and the general sports committee, then appointed, arranged at once for inter-wing matches which proved a constant source of interest and rivalry. At the end of the season, the 42nd Wing led in soccer football, with a record of 26 goals as against 11 secured by opponents in 5 matches. This wing won every game it played.

It was quite natural that with such an excellent reputation, the R.A.F. should be invited to send its representatives to play in the North Texas Soccer Football League. Here, too, a very successful programme was carried out. No game was lost out of five played, and, as a result, the Spalding Trophy,



TILTING.



"THE LONG AND SHORT OF IT!"



CAMP BORDEN REPRESENTATIVE TEAM.

presented each year to the champion team of the League, became the property of the R.F.C. As a token of appreciation of the services rendered by Mr. Frank Morris, a prominent sportsman of Fort Worth, the R.F.C. sports committee presented a shield for competition among the school teams of the Fort Worth League.

Sports led, in natural sequence, to entertainment, and while it is impossible in this history to give the details of the various concerts and entertainments provided by talent of the R.F.C., it must in fairness be stated that these occasions brought out an astonishing and varied amount of talent, which was keenly appreciated by innumerable Texan friends and the unit at large. On one such occasion nearly \$1,200 remained as net profit, and on another some \$800, these two sums being divided between various funds.

On the return of this section of the Force to Canada in April, no time was lost in opening a new and wider field of operation. A representative R.F.C. team was enrolled in the Ontario Provincial Football League, and inter-unit teams were also selected. A very successful eleven was entered in the local Church and Mercantile Cricket League, and the year 1918 saw great activity in all sports, in spite of the difficulty in securing the necessary time and place for training. The record of the football team showed that out of 12 games played, 7 were won, 3 lost and 2 drawn, with 33 goals scored as against 18 by opponents.

In the final match for the championship, the R.A.F. players lost, owing largely to sickness then prevalent.

The inter-unit football league was led at the end of the season by the 43rd Wing.

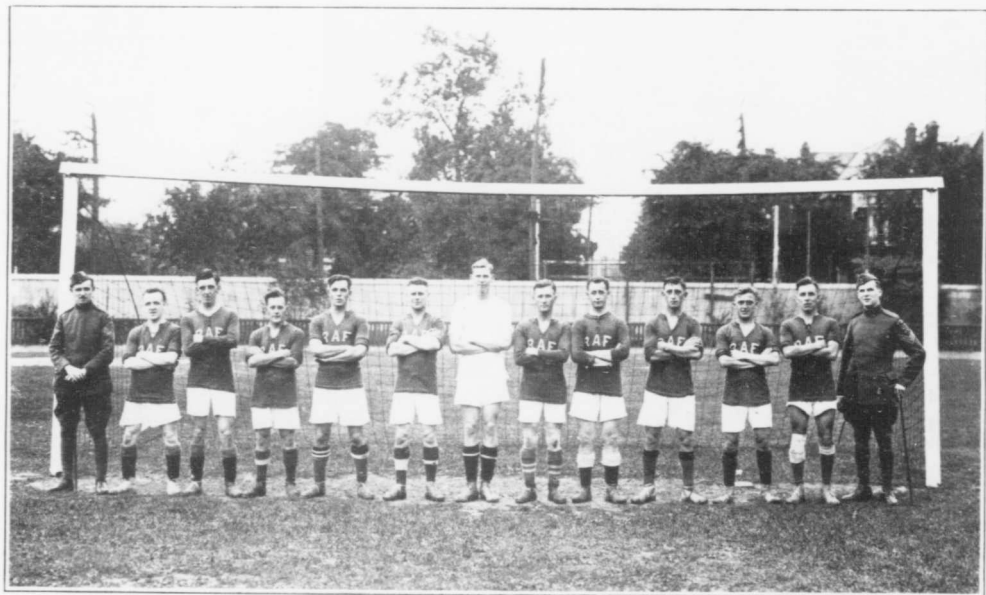
Baseball was, for a time, followed closely, and some excellent talent discovered, especially in the junior units, but it was found to interfere somewhat with other games, and was therefore temporarily suspended.

Boxing took always a prominent part in the athletics of the Corps, and representatives included the feather-weight champion of Canada, the middle-weight champion of America, the 115 lbs. champion of Canada and the welter-weight champion of the West.

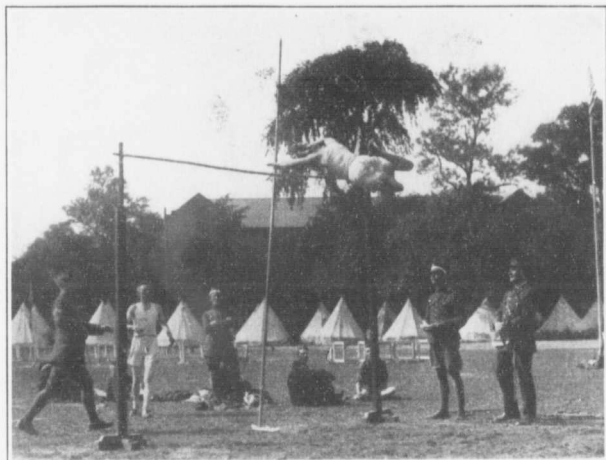
At Borden, aquatic sports were prominent, owing to the fact that an admirable swimming tank had been constructed at this unit. In an aquatic contest the plunge for distance was won, not unnaturally, by a pearl diver from Jamaica, who plunged fifty feet.

Cricket, although a continual source of pleasure and interest was, so far as concerns the brigade, under a handicap, owing to lack of practice and the impossibility of analyzing the merits of individual players. There was discovered, however, a valuable acquisition in an ex-Kent County colt, who was a first-rate class bowler, and was backed up by an extremely steady sergeant-major. Both achieved many successes during the year.

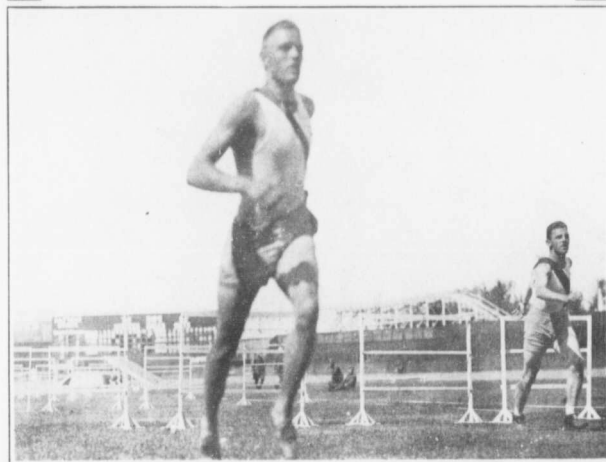
Outstanding in the history of R.A.F. sports are three events. The first was the first annual Sports Day held on August 17th, 1918, at the Island Stadium, Toronto. The second the joint C.E.F. and R.A.F. Sports at Exhibition Camp on September 7th, and third the National Championship Meet at the Great Lakes Training Centre, Chicago, from 20th to 23rd of September, 1918. The first meet, at the Island Stadium was a great success, and will be long remembered by those who participated. The day was perfect, the entries numerous (these of course having been subject to prior elimination tests at the various units) and an excellent track was available. The 456 entries received for various events were reduced to a suitable number, and some 12,000 people filled the great tiers of benches which surround the ground. Both in point of records made, and in the keen sportsmanlike spirit in which the whole affair was carried out, this meet will long remain as representative of a



R.A.F. REPRESENTATIVE SOCCER TEAM, 1916.



"WELL OVER!"



THE CHAMPION.

contest exhibiting the very best desirable quality. A Beamsville cadet carried off the championship cup for the greatest number of points, a remarkable athlete from Dartmouth College. This contestant won no less than five firsts.

The joint C.E.F. and R.A.F. meet took place on September 7th. The latter maintained its reputation for sportsmanship, and succeeded in winning the majority of the contests.

The last large Meet in which the brigade participated was at the Great Lakes Training Station near Chicago. The Corps was somewhat handicapped by having limited time for preliminary training, but, in spite of this, captured four firsts, these being won by the same cadet who had previously covered himself with laurels at the Island Stadium. Such was the success of the R.A.F. on this occasion, that special congratulations were received from the Secretary of State through the Director of Training at the Air Ministry, London. With the coming of winter in 1918 came also orders for demobilization and, in consequence, the large programme of the sports committee was performed abandoned.

In retrospect it appears that the athletics practised have been of the greatest possible value, not only in the maintenance of first-rate physical condition, but also in the fostering of all those principles of sportsmanship and good fellowship without which a military unit can never realize its highest character and efficiency.

ACKNOWLEDGMENTS.

It is desired to give official and universal thanks of the brigade for the great services rendered by many organizations and individuals during its two years' work in Canada. From the first it was recognized that while military training was the object of the Corps, there were other phases of the life of the personnel that were of primary importance. That the work of training has been successful is due in no small degree to the fact that all ranks have benefited both temperamentally and socially by the generous thoughtfulness so continually extended.

No sooner had the wing been formed than the late Colonel Hamilton Merritt and Mrs. Merritt, of Toronto, presented two training machines as an indication of their keen interest in the progress of the flying arm of the Imperial services. Later the City of Toronto followed this example with three machines, Mr. James Carruthers with a similar gift, and the Province of Ontario provided two more.

Colonel Merritt's donation commemorated the battles of Queenston and Lundy's Lane, in October, 1812, and July, 1814, respectively; while Mr. Carruthers' machines were named after three cities in which the donor's interests were principally centred.

The Department of Education of the Ontario Government was most generous in providing splendid libraries, made up of thousands of specially selected books. These were sent, free of cost, to the various units, and proved of the greatest possible interest and value.

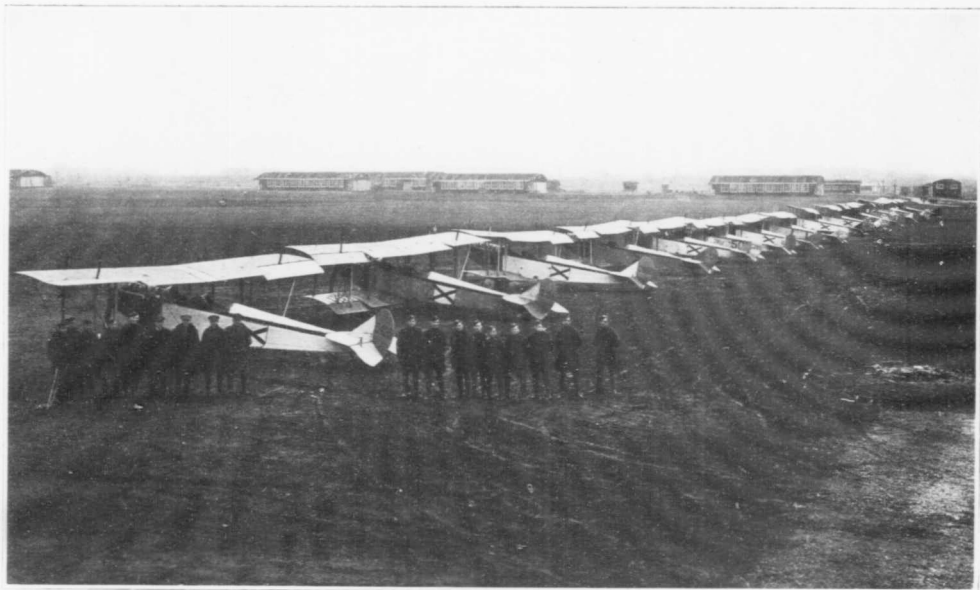
To the Young Men's Christian Association, The Young Women's Christian Association, The Aero Club, originators of the Aviation Fund, to those warm-



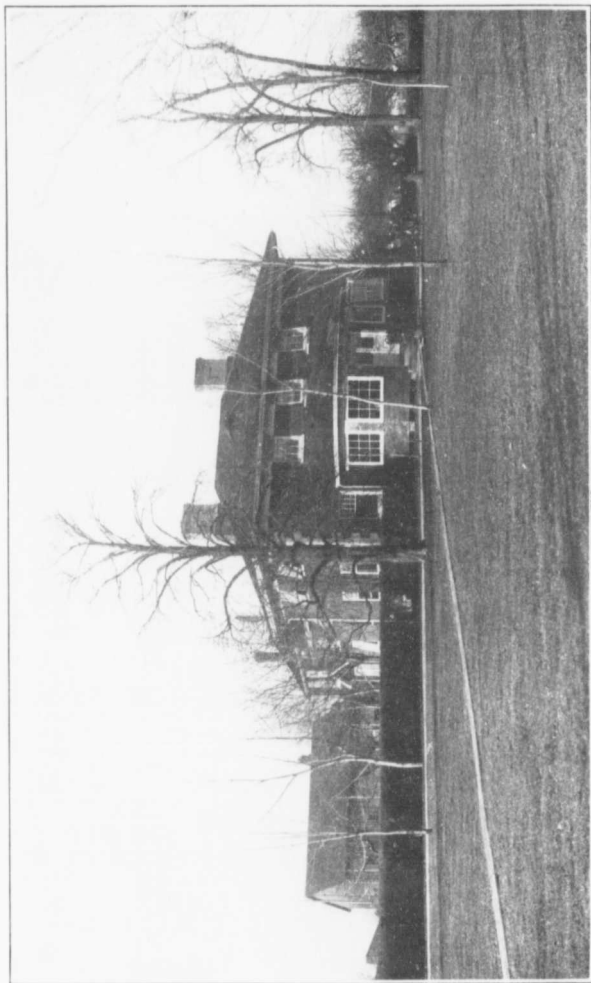
FIRST CANADIAN JN4 MACHINE AT LONG BRANCH,



SECOND PRESENTATION MACHINE GIVEN BY THE LATE COLONEL MERRITT.



85TH SQUADRON, CAMP MOHAWK ✓



LONGWOOD

hearted ladies under whose energy Longwood Convalescent Home did such splendid work for the brigade, to those who were responsible for the King Street Hostess House, and to many others, most grateful acknowledgments are made.

To the omnipresent Y.M.C.A., the members of the brigade owe many and sincere thanks. Animated by the admirable spirit which has always characterized its activities, it seems to have made a special effort to be of service particularly to the cadets and rank and file on the strength of the Canadian Corps. At Camp Borden, the "Y" erected a very large building, splendidly equipped for various purposes, a building of such size as to flout the name of hut, by which it is officially termed. At Long Branch, another was approaching completion just as this unit demobilized. In Toronto, the "Y" doors have invariably been thrown open to all men in uniform, and membership accorded without any fee whatever. At the Central building on College Street, special provision was made to meet the desires of the soldiers in their leisure hours, and the splendid swimming pool, one of the finest on the continent, was at the disposal of all soldiers of the King. To such an extent was this kindness appreciated, that members of the Royal Air Force were in the majority among those who took advantage of these privileges.

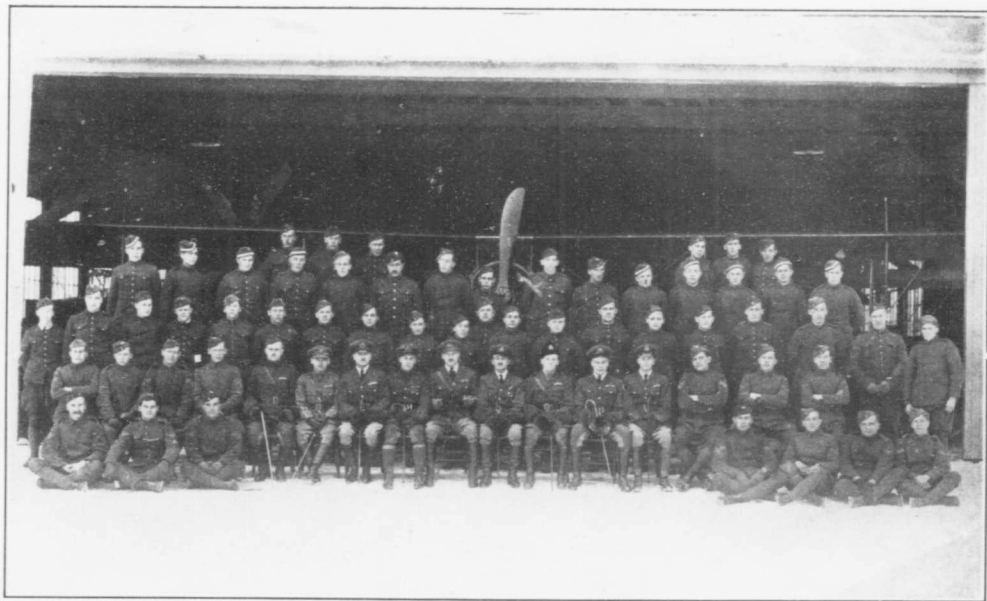
The inner man was especially remembered, and the "Y" cafeteria proved immensely popular. On Victoria Street was a much frequented building for the exclusive use of men in uniform, and the Red Triangle Club soon became the recognized meeting place for rank and file in the city. In consequence, accommodation was constantly on the increase. Here the dining hall service was doubly attractive, being made possible by the voluntary labor of a number of Toronto ladies. It was a club in every sense except one, in that membership is extended only to those who had signified their readiness to serve their country.

The Y.M.C.A. furnished and managed Hostess Houses at Beamsville, Long Branch, Deseronto, Leaside and Camp Borden. This proved a delightful variation from camp routine, and excellent light lunches were provided at most reasonable prices, the latter being especially enjoyed by the girls employed by the R.A.F. This organization also secured for the summer months of 1918, a large residence on St. George Street adjoining the School of Military Aeronautics, which will long be remembered by countless cadets who availed themselves of its hospitality.

The Longwood Convalescent Home, the use of which was kindly donated by Mrs. Charles Beatty through the Canadian Aviation Aid Club, has proved absolutely invaluable in nursing convalescents back to health and strength. It is charmingly situated in some ten acres of grounds about five miles north of Toronto, and being on the main road is accessible both by motor and electric tram.

The upkeep of Longwood has always been a matter of pride and pleasure to the Force. It was formally opened on July 30th, 1917, by Major-General W. A. Logie, C.B., C.F.A.—since Justice Logie—who was at that time General Officer Commanding, Military District No. 2. The furniture, which was of a most comfortable and complete description, including everything imaginable for the amusement of the patients, together with all linen and men's wear, were provided by the Aviation Club, which body has been since its inception a continual source of comfort and help to the brigade.

In the spring of 1918, Longwood Annex was opened, a commodious house standing in the same grounds, and which had a capacity for an additional 24 patients, making 48 in all; but so popular was Longwood that, during this last summer, tents and marquees were pitched on part of the large lawn, accommodating not less than 50 additional patients. It will be thus



84TH SQUADRON, CAMP MOHAWK



INSTRUCTIONAL STAFF, "X" SQUADRON, LONG BRANCH



FIRST BATCH OF CADETS, "X" SQUADRON, LONG BRANCH

seen that about 100 men at a time have been the recipients of most thoughtful care and attention at this Home. Its actual administration was carried out by the Canadian Army Medical Corps through the Base Hospital, and by two excellent nursing sisters who were continually in charge. Nothing was more satisfactory than a visit to this delightful spot, in which, surrounded by garden and orchard, so many healing days were passed by the men of the Force, while above them continually soared the machines of Armour Heights, only a short mile away.

The cost of alterations, repairs and various additions which completed the attractive charm of Longwood was borne by the strength of the R.A.F.,—\$9,800 being raised in voluntary subscriptions from all ranks, and by the sale of waste paper from the various units. Altogether over 850 men have been privileged to convalesce in this admirable institution, and not once has there been any slackening of effort in the valuable service rendered by Mrs. Beatty and the ladies of the Canadian Aviation Aid Club.

Other work of the Club covered an extension of branch organization in most towns and cities in Canada, where appeals for donations were sent out and met with a generous response in comforts and money. Since the Club was affiliated with the R.A.F. Air Committee in London, England, a special effort was made to aid its endeavors, and a sum of nearly \$7,000 had been forwarded to parent headquarters in England by the middle of August, 1918. This was subdivided between the R.A.F. Hospital, the Prisoner's Fund and the Comfort Fund.

The King Street Hostess House, organized by private individuals, was a down-town rallying point for men in both American and Imperial services, and the cadets and airmen of the brigade comprised a great majority of the visitors.

Mrs. Chester Martin and Mrs. Martin Jones, the wife and daughter of the American Consul at Toronto, and Mrs. Ransom, associated with themselves a number of ladies whose voluntary duty it was to make the place exceptionally attractive, and to minister to practically all the needs of uniformed visitors.

The Aero Club of Canada, originated with the visit to the Dominion of the late Colonel C. J. Burke, D.S.O., R.F.C., in 1915, and a recommendation made by him that an organization be formed to control the granting of aeronautical certificates.

In July, 1915, the late Colonel William Hamilton Merritt had an audience with the Dominion Government at Ottawa and was then assured that every official facility would be given to any organization which might aid the Naval and Military authorities in Canada in securing trained pilots. From this interview developed the formation of the Aviation Fund, and later arose the Aero Club of Canada. It was incorporated in December, 1916, and the by-laws adopted at its first meeting provided that all flying officers of the Allies in Canada be made honorary members if they so desired. The first annual meeting took place on March 14th, 1918.

Recruiting for the R.F.C. was given special attention by the Club from its inception, a committee being formed to assist in the obtaining of cadets. The official report of this committee states that thirty local organizations had been formed to obtain candidates throughout Ontario, and that some 3,000 lawyers and clergymen were circularized, as also all college and university students in the Province. The press was used very largely to forward this work. Six thousand application enlistment forms for R.F.C. cadets were distributed in Ontario, and this work carried on till October 12th, 1917, when the Royal Flying Corps took over the local offices and shouldered all its own recruiting.

All cadets of the R.F.C. are honorary members of the Aero Club of Canada. The flying personnel of the Corps found the club and reading rooms (established by the courtesy of the Canadian Military Institute) most valuable in their leisure hours.

As at present constituted, the Club is affiliated with the Royal Aero Club of London, England. Its membership is comprised, amongst others, of some 3,000 members of the R.F.C. personnel, and it has of late been authorized to issue international aeronautical certificates to pilots who have qualified in training.

An irreparable loss was suffered by the death of Colonel Hamilton Merritt, in November, 1918, whose energy, generosity and unflinching enthusiasm had from the first been the chief factor in a most successful history of progress.

To the Aero Club falls the credit for the inauguration of the first Canadian aerial mail. A request was made that the Royal Air Force undertake transportation, all other arrangements being carried out by the Aero Club. The first mail, via the air route, left Toronto for Montreal on June 30th, 1918. This machine, the C-203, piloted by Capt. B. A. Peck with Corporal E. W. Mathers as passenger, arrived at Deseronto, the first stage, in 120 minutes. The following day Montreal was reached in 150 minutes. Leaving on the 24th on the return journey, the pilot made Camp Leaside in six hours' actual flying.

The second mail was carried from Toronto to Ottawa. It left Leaside in C-280, piloted by Lieut. T. Longman on August 15th, returning on August 17th. The easterly flight took 280 minutes and the return trip 220 minutes.

On August 26th, Lieut. A. Dunstan in machine C-282 again carried the mail to the Capital, taking 220 minutes in each direction. Lieut. H. Burton in

the same machine repeated this flight in similar time on September 4th, the latter officer making the round trip in a single day.

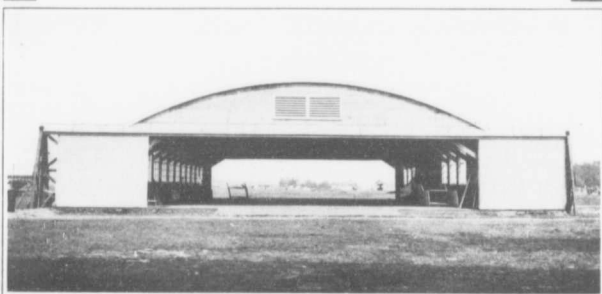
The Aero Club, for the purpose, arranged with the Dominion Government for the use of a special stamp, of the design illustrated. Thus was inaugurated a service which should in the near future develop enormously in this country of great distances.

The above acknowledgments are perforce fragmentary, as it is impossible to extend to each and all in any other form the thanks which the brigade desires to offer. It is hoped, therefore, that those to whom individual reference is not here made will accept this assurance of the great value the unit has placed upon services so generously offered and so gratefully received.

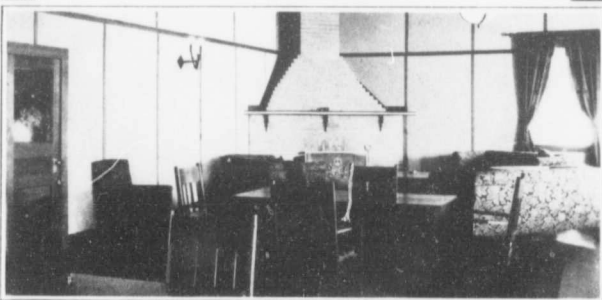




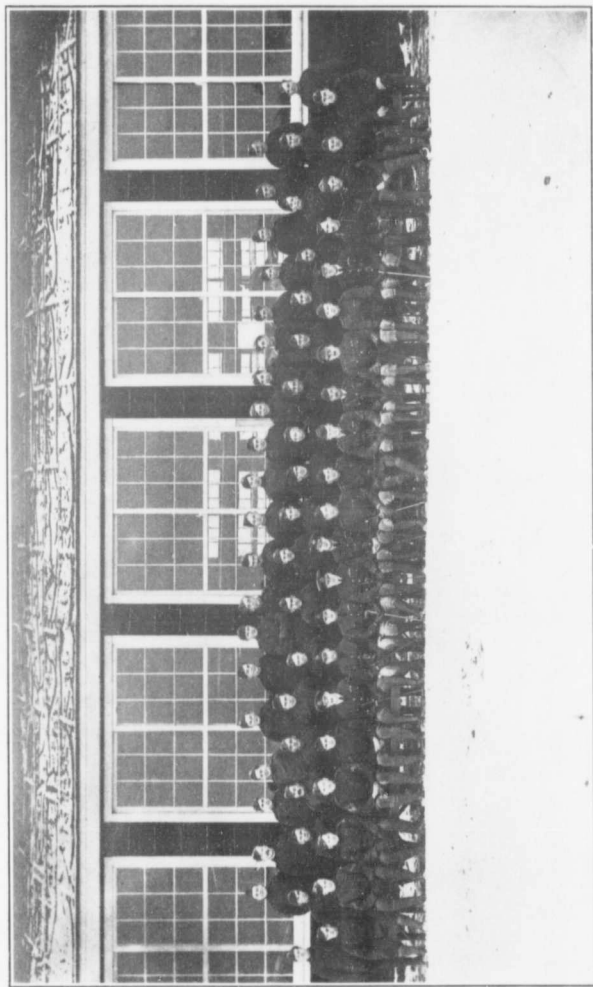
OFFICERS' QUARTERS, LEASIDE.



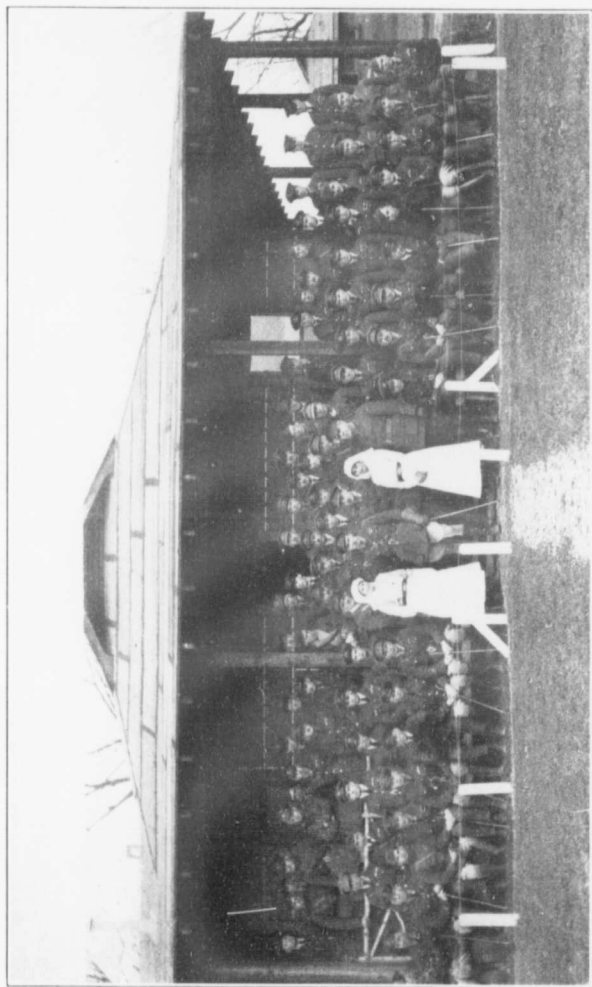
TYPICAL HANGAR.



CORNER IN OFFICERS' MESS, LEASIDE.



79TH SQUADRON, CAMP RATHBUN



OFFICERS AND NURSES, SCHOOL OF AERIAL FIGHTING, BEAMSVILLE

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The following list indicates the Squadrons and Groups of which it has been possible to reproduce photographs. Every effort was made to secure a complete record, but this has not been entirely achieved.

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