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CANADIAN Army JOURNAL

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The Cover
A Staghound armoured car on reconnaissance.

The object of the Canadian Army Journal, which is published by the Directorate of Military Training under authority of the Chief of the General Staff, is to provide officers of the Active, Reserve and Supplementary Reserve Forces with information designed to keep them abreast of current military trends and topics, and to stimulate interest in current military affairs.

OPERATION REDRAMP

By
Brig. R. E. A. Morton,
General Officer Commanding Prairie Command

Part 1

Introduction

The Manitoba Flood of the Spring of 1950 was the worst in the history of the Red River Valley since 1826. Other floods were recorded in 1852, 1886, 1916 and in 1948; in none of these was the water so high or the damage to property in any way so serious.

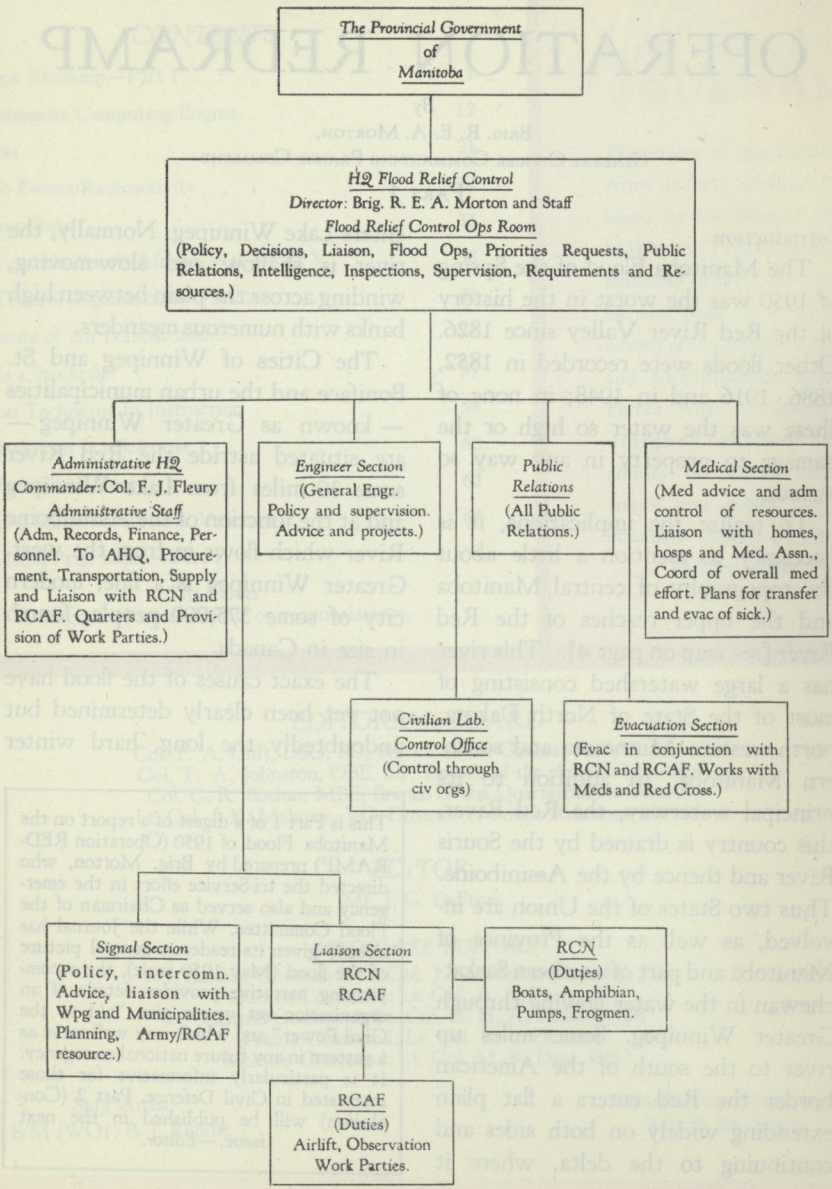
To realize the implications, it is necessary to mention a little about the topography of central Manitoba and the upper reaches of the Red River [see map on page 4]. This river has a large watershed consisting of most of the State of North Dakota, north-western Minnesota and southern Manitoba. In addition to its principal waterway, the Red River, this country is drained by the Souris River and thence by the Assiniboine. Thus two States of the Union are involved, as well as the Province of Manitoba and part of southern Saskatchewan in the water flowing through Greater Winnipeg. Some miles up river to the south of the American border the Red enters a flat plain extending widely on both sides and continuing to the delta, where it enters Lake Winnipeg. Normally, the river is shallow and slow-moving, winding across the plain between high banks with numerous meanders.

The Cities of Winnipeg and St. Boniface and the urban municipalities — known as Greater Winnipeg — are situated astride the Red River some 30 miles from Lake Winnipeg and at the junction of the Assiniboine River which flows in from the west. Greater Winnipeg is a fine, modern city of some 375,000 people, fourth in size in Canada.

The exact causes of the flood have not yet been clearly determined but undoubtedly the long, hard winter

This is Part 1 of a digest of a report on the Manitoba Flood of 1950 (Operation REDRAMP) prepared by Brig. Morton, who directed the tri-Service effort in the emergency and also served as Chairman of the Flood Committee. While the Journal has already given its readers a general picture of the flood (May 1950 issue), the accompanying narrative provides details of an organization set up to give "aid to the Civil Power" and which may well serve as a pattern in any future national emergency. It is particularly informative for those interested in Civil Defence. Part 2 (Conclusion) will be published in the next issue.—*Editor.*

FLOOD RELIEF CONTROL SET-UP THE MANITOBA FLOODS, 1950



Planning Committee
(Advisory)
Chairman:—Brig. R. S. Malone
Brig. W. J. Megill
Members:—Civilian specialists, trades and professions, Army Staff, RCN, RCAF and RCMP. Prov Govt reps. Wpg City Police and Fire Dept reps. Red Cross rep. Public Relations reps.
(Plan for emergency evac BLACKBOY. Consideration of restoration scheme RAINBOW. Keep plan up to date.)

Co-operating Agencies
(Advisory)
Prov Govt Depts:—(DPW, Treas, Agric, Health, Mines and Natural Resources, Education.) City of Wpg, Towns and Municipalities (flood-affected.) Red Cross, Manitoba Command. Central Volunteer Bureau (Mrs. McQueen.) Community Clubs and Ethnic Groups. Railways (CPR and CNR).

The Flood Committee
(Advisory)
Chairman:—Brig. R. E. A. Morton
Members:—Prov of Man reps. City of Wpg and affected municipalities. Comd Engr and Med reps. Red Cross reps. Railway reps. RCMP rep. RCN and RCAF commanders. Central Volunteer Bureau (Mrs. McQueen). Certain others attend from time to time. (Discussion of problems, research, decisions within policy, liaison, appt of sub-coms for closer study, dissemination of inform.)

of '49–'50 and the presence of an exceptional quantity of snow throughout the watershed were largely contributory. The snow appeared to be released by thaw in the USA at a normal date when the ground and rivers in Manitoba were still frozen, while during the flood more snow and rain fell constantly, exaggerating the existing unfavourable situation.

* * *

I think that Operation REDRAMP was a valuable experience for all Service men and especially for all those interested in Civil Defence. It provided a useful insight into the reactions of the public of a large Canadian city threatened by disaster, without the intervention of bomb or shell. The psychological effect on the people of the steady and unpreventable rise of water over a considerable period of time was interesting.

I suppose that we English-speaking democracies are always slow in our preparedness against trouble but we should certainly benefit by experience. It is to be hoped that Disaster Control or Civil Defence will be seriously considered in Canada and much that happened in Winnipeg should be of benefit.

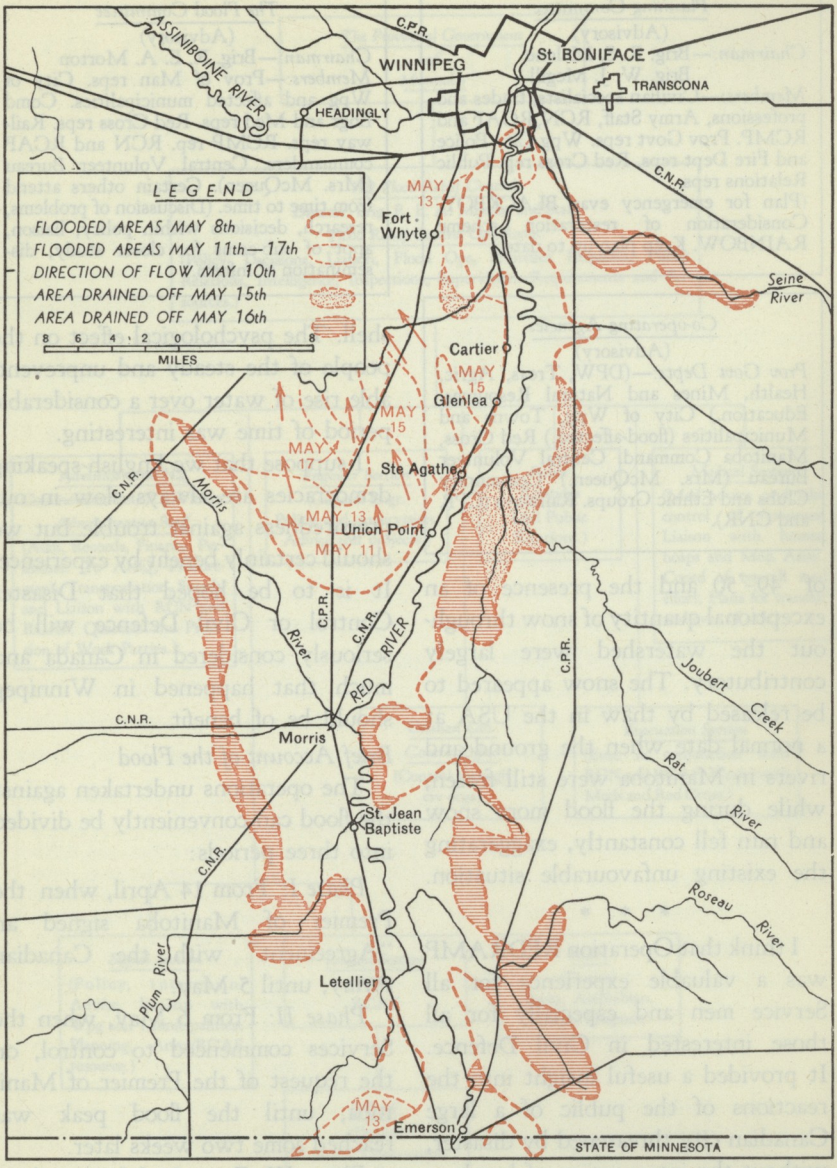
Brief Account of the Flood

The operations undertaken against the flood can conveniently be divided into three periods:

Phase I: From 14 April, when the Premier of Manitoba signed an "Agreement" with the Canadian Army, until 5 May.

Phase II: From 6 May, when the Services commenced to control, on the request of the Premier of Manitoba, until the flood peak was reached some two weeks later.

Phase III: From 21 May until we


LEGEND
FLOODED AREAS MAY 8th
FLOODED AREAS MAY 11th—17th
DIRECTION OF FLOW MAY 10th
AREA DRAINED OFF MAY 15th
AREA DRAINED OFF MAY 16th
8 6 4 2 0 8
MILES
ASSINIBOINE RIVER
C.P.R.
WINNIPEG
St. BONIFACE
TRANSCONA
HEADINGLY
C.N.R.
MAY 13
Fort Whyte
Seine River
Cartier
MAY 15
Glenlea
MAY 15
MAY 17
Ste Agathe
MAY 13
MAY 11
Union Point
C.N.R.
Morris
River
C.P.R.
C.N.R.
RED RIVER
C.P.R.
Joubert Creek
Rat River
Roseau River
C.N.R.
Morris
St. Jean Baptiste
C.N.R.
Plum River
Letellier
MAY 13
Emerson
STATE OF MINNESOTA

handed over control again to the Provincial authorities on 1 June 1950.

At the beginning of April, the flood situation in the upper reaches of the Red River in the USA was becoming serious but no effect was yet felt in Canada; indeed, all the rivers were still frozen over and cold weather still prevailed on the Prairies. By the middle of the month the situation in the USA was indeed serious and one could foresee trouble brewing for Manitoba. I had begun planning with Command resources and had liaised with the RCN and the RCAF, and on 14 April we invited Premier Campbell to sign an Agreement in the event that the Province would need our resources and assistance.

Brig. Morton

In order to be immediately ready when the Government should ask for our services, I drew up a Warning Order on 18 April detailing "Flood Platoons" to be formed from our own Active Force personnel in Winnipeg and at the same time I received assurance of several similarly organized "platoons" from No. 11 Group RCAF. The RCN(R)—H.M.C.S. Chippawa—also agreed to co-operate. When the time came, a week or so later, both Services did so most willingly and well. As a reserve, to be called for if really required, I issued a Warning Order for the Royal Canadian Horse Artillery, The Royal Canadian School of Artillery in Shilo, and the Canadian Joint Air Training Centre (Army Component) in Rivers, though I hoped that I would not have to interrupt their proper training functions by flood duty.

The resources that we had in the Command for flood control—sandbags, rubber boots, amphibious vehicles, pumps, etc., were readied and the first item was issued to the authorities concerned. I had also appointed our GSO I—Lt. Col. J. W. Ritchie— and our AA & QMG—Lt. Col. R. B. Haley—as the Army's representatives for flood control. Lt. Col. J. Blair, Command Engineer Officer, was also made responsible for the engineer-

ing aspects of any operations to be undertaken.

By 5 May the situation in Greater Winnipeg had become critical, largely due to the continued rain and snow increasing the flood waters and damaging the hurriedly constructed dykes. I had called in the RCHA for flood duty and was bringing in the next unit, the RCS of A, when Phase I ended.

At about eleven o'clock on 5/6 May 50, I was summoned by Premier Campbell to attend an emergency meeting at the Provincial Legislative Buildings in relation to the flood. I brought Lt. Cols. Ritchie and Haley with me and found a representative gathering of public men from the Province and Municipalities had been called in. The situation was deemed to be serious and after some discussion, the Premier asked me to take over as Coordinator of Flood Relief and head up a combined tri-Service effort to fight the flood. I was also asked to act as Chairman of the Flood Committee which was formed out of those then present; this was later added to considerably. As a result of the request by the Province and Mr. Claxton's (Minister of National Defence) concurrence, I took over the task with effect from 1000 hrs. that day (6 May 50).

The prevailing situation at midnight was bad, with every indication of a further worsening. The feeble dyke then protecting the hospitals in Riverview was not thought capable of holding any longer, so after some discussion it was decided to begin evacuating patients at once.

However, these hospitals were all cleared in the next few days by DUKW and boat.

As experience was gained in the first week, the organizational plan was altered and added to somewhat but was materially the same as its original form [see chart on page 2]. We early decided, due to the emergency, that we would require three Staff Officers, one each on an eight-hour shift for staff duties at Flood Control HQ. This was proved to be necessary, though we were able to cut down after Phase II. As I deemed it necessary to be present myself or to provide a deputy at Flood Control HQ during the 24 hours, I sought the assistance of the Reserve Force Brigade Commanders in the Winnipeg Garrison. Both Brigadier J. W. Brice, Commanding 4 Army Group Royal Artillery (Anti-Aircraft), and Brigadier O. M. M. Kay, Commanding 16 Infantry Brigade, agreed to being called out and left their jobs to help me. They went on an 8-hour shift also and when I was at Flood Control HQ the one on duty was free to inspect the dykes.

It was early apparent that accurate and timely information from the various dyke centres was of great importance to Control HQ. So we

established a number of wireless Control Stations with two officers and two Driver Operators, each operating on 8-hour shifts; as they were netted to Control HQ and in touch with the local situation and the local "Commander" (civil or military), this scheme provided us with much useful and early information.

On 7 May, we decided to add an Intelligence Section to Flood Control HQ, manned by Intelligence personnel from Command HQ. Their duties were similar to those at a Field HQ, with the addition of securing information about the flood level and the weather forecasts.

One unfortunate disadvantage under which we worked was our inability to get ahead of the flood during the first week of taking over. As resources began to accumulate, we arrived at a better footing and could at last plan in advance.

I have not the space to give an account from day to day of our activities — successes and defeats — in this most interesting of the three phases. In the next chapter of Part I, I have included an account of various aspects of interest in the flood.

I think that Phase III can be considered to have begun about 21 May 50, at the time of the visit of the Right Hon. Louis St. Laurent, Prime Minister of Canada. After a day or so of little rise, we were able to hope that the peak had at last been reached. This hope was later justified, though at the time it was hard to assess the effect on the water level of the two big artificial lakes, which had spread out for hundreds of square miles either side of the border at Emerson.

The RCAF resources for flood relief involved planes and crews all over Canada, in addition to their excellent local Active Force and Reserve Force effort, all being on call by Air Commodore Costello in Winnipeg. On 20 May, the water was only about a foot below the top of the dykes and until the water had proved to be in recession and had reached a good margin of safety below the dykes, it was imprudent to release any troops. Thereafter, we began to reduce our Active Force personnel and continued to remind the citizens of the possibility of their services being again needed.

By the end of May, we had been able to reduce the forces considerably but retained sufficient RCN personnel to provide a Headquarters and to man the seven DUKWs; we also kept back the RCHA. The latter were organized to patrol and maintain the dykes and provide "flying columns" for any sudden break. Wireless communications had also been cut to the minimum but was still kept operative for any emergency. This decrease of strength was possible by reason of the steady fall of the

flooded rivers, at approximately 6″ per diem, and our ability in practice to rush "flood platoons" rapidly to any danger spot.

So upon receiving the concurrence of Premier Campbell, we ceased to co-ordinate and control the flood situation with effect from 1 June 1950. There were still some personnel remaining whom we required, as mentioned above.

VARIOUS ASPECTS OF THE FLOOD

Nature of the Flood

The Red River Flood of 1950 was unlike that of the Fraser Valley of 1948, which was by report a wild rush of waters down valleys from the mountains toward the sea. The flow in our case was slow and continuous, the waters of the Red River rising from 3″ to 6″ daily. As the river overflowed its banks, the water spread outwards over the flat country, forming ponds and filling up lower ground. These ponds would gradually rise and spread out further, forced on by the pressure behind. Everywhere the flood came slowly, little fingers of water trickling on, spreading around and under obstacles and gradually building up depth. These artificial lakes and open stretches of water were subject to the effects of current and wind and would become quite rough; this caused considerable damage to property.

In many places there was considerable pressure and along its original course the river ran at an estimated speed of some 15 to 20 miles per hour.

In the earlier stages of the flood, one could generally forecast where the water would flow by reading a contoured map but as the level rose, the water became more dynamic and pressure forced it on. This was felt less in built-up areas among houses, where it was easier to control. Another aspect that proved hard to explain to people was the effect of the difference in level up and down stream. They were prepared for flooding outwards from the river towards them but were surprised when water which had overflowed upstream, approached them overland.

Employment of Services

The Liaison Sections of RCN and RCAF worked 24 hours and were of great help in their advice and communications regarding their Services. The RCN under Commander L. R. Main were based on HMCS "Chippawa", itself constantly in danger of flooding and heavily dyked to prevent it going afloat. The RCAF under Air Commodore M. Costello were based at their Air Station at Stevenson Field, which was on comparatively high ground. I cannot speak too highly of the

constant, cheerful co-operation of these two senior officers and of their staffs and men throughout the operation. These two Services were paramount in their respective elements. The vital importance of marine efforts can easily be visualized in an operation like REDRAMP, but the work of the RCAF was less easily assessed or observed. However, without the remarkable air bridge which they so rapidly created between Winnipeg and Eastern and Western Canada and parts of the USA it is hard to see how we could have withstood the flood, for our resources would have arrived too late.

The RCMP under Asst. Commissioner J. Bird, reinforced by Detachments outside Manitoba, did a fine job indeed. They thickened up the scanty police forces of the urban municipalities of Greater Winnipeg, being employed mostly on water patrols. But probably their most vital role took place in the flood swept rural municipalities — notably in Morris. We had lent them wireless sets early during the flood and co-operated with them in such places as Emerson, Gretna, and Morris. When the waters struck Winnipeg, we were obliged to draw in our resources there but the RCMP continued to police the flooded areas and to help citizens and farmers throughout, until we were at last able at the end of May to send them DUKWs and other amphibious vehicles to Morris.

The part played by our Administrative HQ under Colonel F. J. Fleury in Fort Osborne Barracks was a very important one. It was a great assistance to Flood Control HQ to have this Rear HQ so capably caring for administration, records, accounting and communications with higher formations and to be free to carry out our tasks as a Control HQ. The supply, accommodation, transportation and allocation to tasks of the thousands of Active and Reserve Force personnel was itself a very extensive job and on a 24-hour basis. This Echelon was built up from the normal Command HQ but was without the personnel allocated to Flood Control HQ. It was, of course, required to function as a normal Command HQ, but thanks to the sympathetic understanding of Army Headquarters [[Ottawa]], its duties in this respect were light.

The Reserve Force units of the Winnipeg Garrison, together with the 21 Field Squadron, RCE, from Flin Flon, turned out in good numbers on the call-out and performed in a most creditable manner indeed. Those were excused who were already heavily implicated in vital flood work, such as the City Police or City Engineers Departments. At first, we put them in as units where they were most needed, such as the Assiniboine River overflows; later we allocated

them to certain sectors. The 21 Field Squadron were considered special troops and, with the 23 Field Squadron (Active Force) from Western Command, were kept for the Command Engineer's disposal. The Fort Gary Horse under Lt. Col. A. A. Hugman deserve special mention. Several days before call-out, they took over voluntarily and as a unit the dangerous Point Douglas area — a district including the CPR Station and numerous factories and warehouses. All the Reserve Force units lived in their armouries and carried out their own administration; this proved valuable and beneficial experience.

Other units and HQ assisted our efforts—locally in assisting the Red Cross handling of refugees, like the 26 Field Regt., RCA, in Brandon. HQ Saskatchewan Area under Lt. Col. R. C. Clark sent us Ordnance and other resources, provided personnel, assisted in refugee problems and planned and prepared for a complete evacuation scheme.

Public Relations

A very important aspect of our work was our relations with the public. It was obviously necessary to have their confidence and support under existing circumstances. . .

Our press relations were also very cordial indeed. As I have mentioned before, I always attended our daily morning Press Conference myself, though it was run by Capt. Donoghue, my Public Relations officer, or by Lt. Col. J. K. Mahony, VC, Director of Public Relations, AHQ, Ottawa. In attendance from Flood Control HQ we had Lt. Col. Blair (Engineers), a senior Medical Officer, a representative from the Evacuation Section, Navy and Air representatives, and a representative from the Provincial Department of Mines and Resources to furnish flood forecasts. The Intelligence Officer opened the conference by giving the current situation, then the other representatives would give their angle and the Press would ask questions.

Vulnerable Points

In a large modern city there are, of course, a number of points especially sensitive to damage or dislocation.

The following appear to be the principal vulnerable points, as we saw them:

Power Stations: There are two systems serving Greater Winnipeg—The Hydro and the Winnipeg Electric—and both stations are situated on or close beside the Red River. These were not strongly enough protected when we took over and were a cause of considerable anxiety; but our work parties, assisted by the workmen themselves, soon had them practically impregnable though surrounded by the flood.

The Gas Works is also situated on

the river. While not so vital as the Power Plants, this installation was important principally because all the bread in Winnipeg is baked in gas ovens.

The Main Telephone Exchange in Winnipeg is situated downtown near the River and this was also in a somewhat precarious condition at first.

Railway Bridges: The trans-Canada main lines of both railways cross the Red River by two bridges. There are no others now between Emerson and Lake Winnipeg, so these were obviously important. For a while, the CNR bridge was practically the only means of egress from St. Boniface to Winnipeg. At the height of the flood two bridges were threatened, the CPR at the Point Douglas subway beside the Red River and the CNR at their Assiniboine River bridge.

Road Bridges: There are four over the Red in Greater Winnipeg and one disused railway bridge, which would only be useful in an emergency. The Norwood and Provencher bridges serve St. Boniface and Norwood and other south-east localities. For a time both were out, but thanks to the Winnipeg City Engineers, the Provencher was soon re-opened. The other two bridges, lower down the river, were generally usable throughout, but the Louise bridge was only suitable for high clearance vehicles and it was closed for a while. The situation here was adequately served by the two bridges but it left nothing for a further emergency. Over the Assiniboine River, only one of the normal four, between Headingly and the junction with the Red in Winnipeg, was put out of action. Heavy dyking and pumping saved the two furthest downriver subjected to the most severe flooding.

Hospitals, Sanitaria and Nursing Homes: On the East side of the Red River, there are three large hospitals all situated on the River. On the Winnipeg side there are five, two on the Red and one on the Assiniboine, where it was flooding. As well, there are a number of smaller hospitals, nursing homes and Old Folks' institutions. Only two hospitals on the Winnipeg side were considered safe; of the others, The King Edward group was overrun the night we took over and the others required evacuation.

Roads and Railways: In flooded areas, of course, these went out. With a few exceptions, which had to be dyked, vital ones were not threatened except at bridge crossings.

Other possible vulnerable points such as subpower stations, telephone exchanges, radio stations, the City Hall, Police and fire stations, food storage warehouses, the air field and the like were not seriously threatened by the flood at the level it reached. Action in case of a further rise was visualized in Operation BLACKBOY.

(To be continued)

THE AUTOMATIC COMPUTING ENGINE

By
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Directorate of Armament Development, Army Headquarters,
Ottawa

A lot is being written these days about the large new electro-mechanical computors used by Britain and the United States to solve the increasingly complex equations of science and technology. Until recently such machines have only been available to the Armed Services. What is their purpose and how do they work? Here I try to give a few answers. Nearly all the detailed references are to the British-made ACE (Automatic Computing Engine), but the principles can be applied to any of these new and immensely powerful weapons.

The purpose for which such calculators exist is to obtain practical solutions to a variety of equations which crop up in many scientific fields, of which ballistics, aviation and nuclear physics are examples.

Scientists with a problem can usually form a set of equations which, when solved, will give the answer. But sometimes these equations are incomplete, and to solve them it is necessary to go through long and tedious numerical substitutions. This means trying a set of different values for each unknown and comparing the many answers that are obtained. In a tank, for example, we may wish to see how we can alter such variables as armour thickness, firepower, range of action, width of track and manoeuvrability and still keep within the weight and width limits imposed by bridging. In principle the trial method is easy — but if an equation has four unknown each with 10 possible values, there may be ten thousand solutions! And a complex expression may require two or three hours work for each one of the substitutions (as ballisticians well know). This being so, the above problem might take 20,000 hours to solve, which on a normal working basis would be six to eight years. An electronic computor could do the work in a few hours.

Or again we may have several hundred differential equations with several hundred unknowns requiring simultaneous solution. In high school days, four equations with four unknowns was quite a lot. But the

calculator takes the larger problem in its stride and may even require less time and be more accurate with its hundreds than the struggling student with his three or four. A recent problem which was estimated to need 100 years for solution by human brains was done by such a machine in 103 hours. Ballistic problems requiring days of human effort are done by electronic computors in minutes or even seconds.

What is the secret of these machines? First let us consider how numbers can be handled by electric circuits. In our normal system of counting we make use of the decimal system, that is, we use the digits 0 to 9 and make our divisions 10, 100, 1000, 10000, and so on. This happens to be so because man first learned to count on his fingers. In an electric circuit we have not the variety offered by 10 fingers. In fact we are restricted to one of two alternatives: we either have a voltage or we have

Decimal		*Binomial*
1 (1)	equals	1 (1)
2 (2)	"	10 (10)
3 (2+1)	"	11 (10+1)
4 (2^2)	"	100 (10^2)
5 (2^2+1)	"	101 (10^2+1)
6 (2^2+2)	"	110 (10^2+10)
7 (2^2+2+1)	"	111 (10^2+10+1)
8 (2^3)	"	1000 (10^3)
9 (2^3+1)	"	1001 (10^3+1)
10 (2^3+2)	"	1010 (10^3+10)
11 (2^3+2+1)	"	1011 (10^3+10+1)
12 (2^3+2^2)	"	1100 (10^3+10^2)
etc.		etc.

FIG. 1

$$\begin{aligned} 459 &= 400 + 50 + 9 \\ &= 4\text{x}10^2 + 5\text{x}10 + 9 \\ &= 4\ 5\ 9 \end{aligned}$$

Decimal system with powers of 10 and digits 0 to 9.

$$\begin{aligned} 459 &= 256 + 128 + 64 + 0 + 0 + 8 + 0 + 2 + 1 \\ &= 1\text{x}2^8 + 1\text{x}2^7 + 1\text{x}2^6 + 0\text{x}2^5 + 0\text{x}2^4 + 1\text{x}2^3 + 0\text{x}2^2 + 1\text{x}2 + 1 \\ &= 1\ 1\ 1\ 0\ 0\ 1\ 0\ 1\ 1 \end{aligned}$$

Binomial system with powers of 2 and digits 0 and 1.

FIG. 2

not a voltage. We must therefore use a binomial or system of 2 rather than a decimal or system of 10. This means we use the digits 0 and 1 instead of 0 to 9 and we make our divisions 2, 4, 8, 16, 32, etc., instead of 10, 100, 1000, 10000, etc. Figure 1 shows what the binomial system looks like alongside the decimal system. Note how 10, 100, 1000 now represent 2, 4, 8, etc. Figure 2 shows the number 459 written in both systems.

Electrically, the representation of a number is now a very simple matter. A pulse of voltage one millionth of a second (a microsecond) in length represents a 1 and no pulse of voltage, also a miscrosecond in length is a zero (See figure 3). There is one other convention to observe. In adding and subtracting

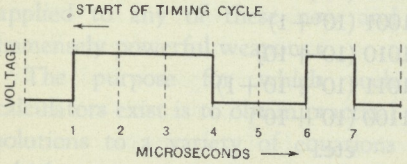


FIG. 3

Pulses, each lasting one microsecond. This represents 0111001 or 78 in the decimal system.

we normally work our sum from right to left. In electronics, however, one represents passage of time graphically by going from left to right. We, therefore, in dealing with the machine write all the binomial numbers backwards and do our adding and subtracting from left to right. In figure 3 the number 78 is written 0111001 instead of 1001110.

Perhaps the binomial system appears a bit artificial. This is not true, for it has stood the test of time over several 100 million years and during this last million it has made possible the functioning of that 10-billion-celled gadget, the human brain. The brain, of course, is far more flexible than the machine; it is much more complex, contains an exceptional memory system and has a wonderful efficiency. The machine is much faster, however, on the types of mathematical computation already mentioned.

The next problem is to see how the machine distinguishes between different numbers since the pulses all look alike. This is done by timing cycles operating through the entire system. In the ACE the cycles come every 32 microseconds. Numbers are always started in the machine at the beginning of one of the cycles. In this way numbers that are to be added or multiplied or which have to undergo any other operation will always arrive at the adding, multiplying or other circuit in the correct relation to one another. If a number is longer than 32 microseconds in length, then there are ways in which 2 cycles (or any other number) can be joined together. The biggest number handled by 32 microseconds is 4,294,967,295, which in the binomial system is a series of 32 ones

or $(2^{32}-1)$.

Numbers are fed into the machine on cards with holes punched for the 1's and no holes for the 0's. Brushes make contact through the holes to establish the voltages.

Once inside the machine, if travelling from one part to another or if going through some functional circuit (adding, multiplying, etc.), the pulses travel at a velocity comparable with light. Obviously they have to start and stop somewhere and frequently have to be stored for varying lengths of time while other parts of the problem are being solved. Perhaps a dozen numbers have to be compared by the machine to find which is the largest. This would be done by comparing the first two numbers, selecting the largest, comparing it with the third, selecting the largest, comparing it with the fourth, and so on. Although this operation would be timed in microseconds, the 12th number would still have a relatively long wait while the successive comparisons were being made.

How do these storage or "memory" systems work? A number of mechanical systems are available on the gramophone or wire recording principle, but these all have the disadvantage of being slow though they can remember for a long time.

The method of the ACE is a mercury delay line similar to that in Moving Target Indication. It works as follows. The pulse voltages are fed to what is called a piezo-electric crystal. This crystal is placed at the end of a column of mercury and the incoming voltage makes the crystal vibrate. In doing this the electric pulses travelling at many thousands of miles a second are transformed into pressure pulses travelling at a few centimetres a second down the column of mercury. When they reach the other end of the column a second crystal performs the reverse function and transforms the pressure pulses back into electric pulses again. These will have become weakened so they are passed through an amplifier which restores their strength and then they are again put back into the delay line and the process can be repeated over and over. If it is a short line it may only take a pulse 32 microseconds per cycle. Longer lines take 1024 microseconds — over a thousandth of a second.

The latest American machines employ storage tubes. An electron beam scans a non-conducting screen and leaves behind tiny packets of electrons at points where pulses occur. The screen retains its pattern of minute charges for a considerable time, and when it is re-scanned the original set of pulses can be taken off and put to any required use. This may prove to be the best memory system so far.

Next we shall consider how a set of pulses representing a number can be moved from one part of the machine to another. For example, it might be taken out of a delay line and moved to another delay line forming part of the adding circuit. After addition the resulting sum might be moved to some new delay line or possibly returned to a line from which one of the original numbers came. How are these moves accomplished?

In the latest version of the ACE there are 512 sources or places (such as delay lines) from which a number can be taken. There are also 512 destinations to which it can be sent. Nine voltages control the paths leading from the sources and another nine control those going to the destinations. These 18 voltages can take a number from any one of 512 sources and move it to any one of 512 destinations. These controlling voltages last for at least 32 micro-seconds and sometimes longer, i.e. they must allow time for a number to leave (or enter) a delay line.

Figure 4 shows how this works. There are sixteen sources (numbered 1 to 16) with four control voltages (Roman numerals). A voltage on IV opens a path to the odd sources 1, 3, 5, 7, 9, etc. No voltage on IV opens the path to the even sources 2, 4, 6, 8, 10, etc. Similarly a voltage on III opens h, k, m and o. No voltage

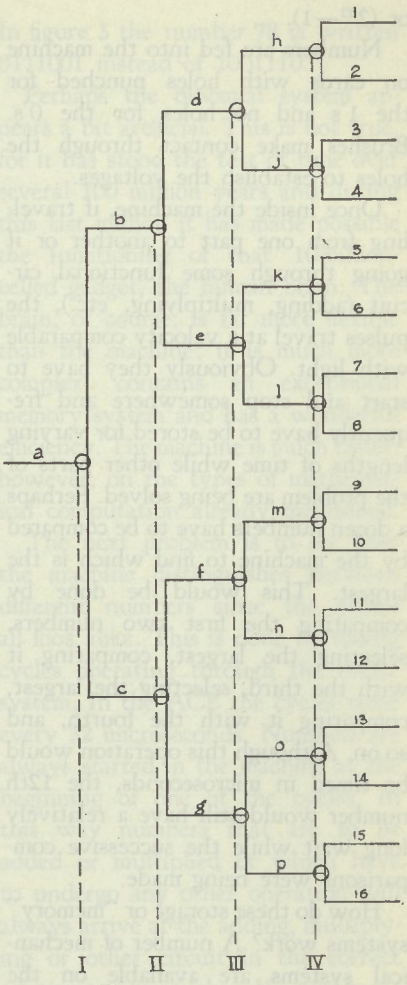


FIG. 4

opens j, l, n and p. Voltage on II opens d and f. No voltage, e and g. And voltage or no voltage on I opens either b or c. Thus by various combinations of voltage and no voltage on I, II, III and IV we

control 16 sources, allowing a through path for only one of them. For example, a voltage on I, no voltages on II and III and a voltage on IV opens a path to source 7. It will be seen that for each control voltage the number of possible sources is doubled. With 4 controls we have 16 sources. In the ACE with 9 controls we have 512. All this applies equally to destinations except that the pulses are going from left to right in the diagram instead of right to left.

How are the control voltages established and what guides their timing? They come from the machine's control circuit. Instructions are given to this circuit in the form of two 32 microsecond numbers fed in on hole punched cards like the numbers used in the computation itself. The 64 spaces (2 lots of 32) on the instruction card are numbered and divided into groups which perform specific functions. Spaces 2 to 10 control the source, while 11 to 19 control destination and 27 to 32 control timing. In the second half of the instruction 2 to 10 cover a second source, 11 to 21 are a delay function, and so on. Though a control pulse lasts only a millionth of a second, yet each one is accurately directed to do a particular job by a timing device which operates automatically and continuously. This times the start of the instruction and then opens a set of 32 channels one after the other for a microsecond each to allow the corresponding pulse to find its correct place. The same procedure is repeated for the last half of the instruction.

Pulses controlling the source and the destination are used to operate a series of trigger circuits. Such circuits, when they receive a single pulse, will start sending out a continuous voltage until shut off. These voltages generally operate for 32 microseconds, which conforms with the timing system and allows a number to clear a delay line at the source or move into one at the destination. At the end of this period, unless instructed to the contrary, the trigger circuits are automatically shut off to be ready for the next operation.

Following is a description of one brief mathematical operation by the machine — addition.

First we must examine the process of addition in the binomial system. Recalling that the numbers 1, 2 and 3 in the binomial system are 1, 10 and 11, we can add the following (from left to right):

$$\begin{array}{r} 11 \text{ CARRY} \\ A = 1110 \\ B = 0110 \\ \hline A + B = 1011 \end{array}$$

0 plus 1 makes 1 with none to carry. 1 plus 1 makes 10 (2), put down 0 and carry 1. 1 plus 1 plus 1 makes 11

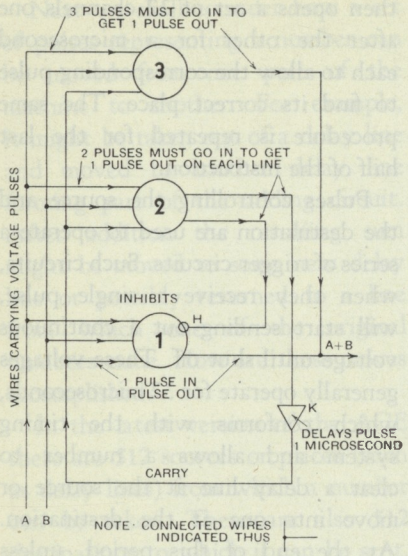


FIG. 5

(3), put down 1 and carry 1. Lastly, 0 plus 0 plus 1 makes 1. It will be seen that this involves three different operations:

	: *Sum*	*Carry*
1 plus 0 plus 0 gives 1 and carry 0	:	
1 plus 1 plus 0 gives 0 and carry 1	:	
1 plus 1 plus 1 gives 1 and carry 1	:	

We must now find an electric circuit such that when it receives pulses as shown on the left will give out pulses for the sum and carry as shown on the right. Here it is (Fig. 5). The numbers in the circles indicate the smallest number of simultaneous pulses that must enter each circle from the left to have one pulse leave by each line on the right. If the number of pulses entering a circle are less than the number shown, nothing happens. Details on how this is done are given further on. A pulse from ② coming down to H will prevent any simultaneous pulse passing through ①, i.e. such a pulse "inhibits" ①. At the same time the pulse from ② that goes to K is delayed at point K for one microsecond and then goes on to be added in with A and B during the following microsecond.

Let us see what happens when we go through the three operations outlined above. When one pulse comes in on either A, B or CARRY, it passes through ① but is stopped at ② and ③. This gives us one pulse in the output A + B with nothing in the carry circuit, K. 1 plus 0 plus 0 gives 1 (Sum) and 0 to carry.

If 2 pulses come in on either of A, B or CARRY they will try to enter all three circles. They cannot pass through ③. They will, however, pass through ② and one of the resulting pulses from here will inhibit ① and thus prevent them getting through there. The other outgoing pulse from ② is in the carry circuit where it is delayed a microsecond by K. Thus the result of this operation is that there is nothing in

the output A + B but one pulse is being carried forward. In other words, 1 plus 1 makes 10 (2), put down 0 and carry 1.

Last of all is when there are three pulses, A, B and CARRY. These will pass through ② whose inhibiting pulse will prevent them from passing through ①. They will also pass through ③. This means that there will be one pulse in the output A+B which comes from ③ and one pulse in the carry circuit coming from ②. In words, 1 plus 1 plus 1 makes 11 (3), put down 1 and carry 1.

The above circuits are all quite elementary. A radio tube can be made non-conducting by lowering the voltage on its "grid" electrode. By giving this a suitable negative voltage it can be made to require one, two or three simultaneous positive voltages to cancel the "grid bias" and make the tube conduct. Inhibiting can be done by putting such a heavy negative bias on the grid that the positive pulses still cannot bring the tube into conduction.

Before closing I would again emphasize that these machines until recently have been used almost entirely by the Armed Services. They are of particular value in development work. This is why they are not so well known in Canada, for although we produce many manufactured articles, the development is usually done in the United States or in England.

A typical application is in gun design. We wish to build a gun with a certain range, calibre, weight and so on. A number of designs are possible and for each one it will be necessary to compute the trajectories followed by the shell at various angles of elevation. Only when these have been worked out in detail can

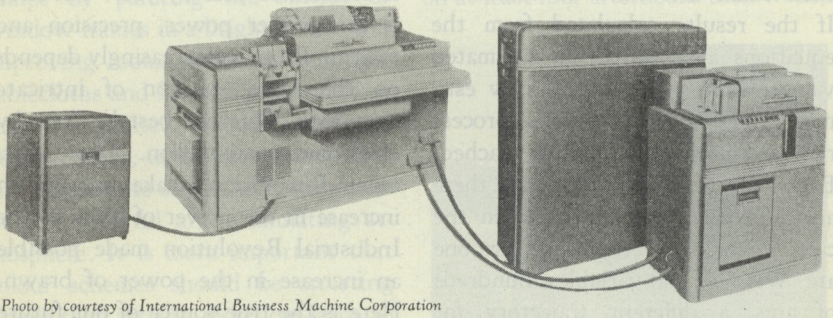


Photo by courtesy of International Business Machine Corporation

The Card-Programmed Electronic Calculator: The four units, left to right, are a Supplemental Storage Unit (memory), Accounting Unit (accepts instructions, records operation, prints results), Electronic Calculator (high-speed computation), and Summary Punch (records results in punched card form).

it be said which gun will prove the best when built.

In calculating a trajectory we must know four things, first the horizontal distance the shell has travelled since leaving the gun, second its height above the ground, third its velocity and last, the angle this makes with the horizontal. These four variables must be known at every point along the trajectory. We therefore divide the trajectory up into a great number of small arcs and starting at the muzzle of the gun where our variables are known, we calculate what they will be at the end of the first small arc. When these values are known we go on to the second arc. Then the third, fourth, fifth and so on to the end of the line. The process is not difficult but it is tedious. There is no way of working out the equations to exact answers and to obtain solutions the variables for each small arc must be estimated. If the results calculated from the equations agree with the estimated values, all is well. If not, new estimates must be made and the process repeated until agreement is reached. Even with an accurate estimate there are more than a dozen steps in the calculation of one variable for one arc. With several variables, hundreds of arcs, a different trajectory for each elevation and a number of possible gun designs, the problem of finding the best can occupy a battery of human computors for many weeks. In war, when better guns are needed, time is precious and manpower is scarce, no one can doubt the value of an electronic computor. The above small arc calculation is based on a process called numerical integration for which the Electronic Numerical Integrator and Computor was devised at the University of Pennsylvania during World War II. *The speed of such a computor can be judged by the fact that if the problem of calculating the small arc values was started in the machine at the same time as the gun was fired, it is the machine that would win the race to the target, punching out answers for points along the trajectory faster than the shell could reach them in its flight!*

The Industrial Revolution has created a world whose rate of change is accelerated year by year. The need is for greater power, precision and control. Progress increasingly depends on the rapid solution of intricate equations. This can best be done by electronic computation. The "Electronic Revolution" makes possible an increase in the power of brain as the Industrial Revolution made possible an increase in the power of brawn. Here is the true source of our future technical might.

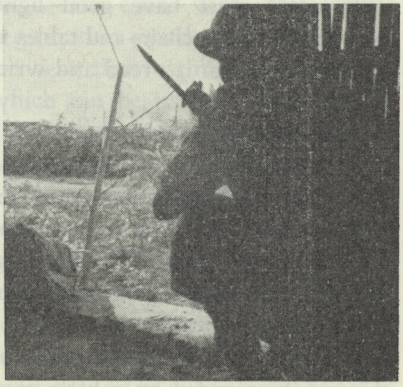
ALERTNESS

CONDENSED FROM AN ARTICLE BY GENERAL SIR HAROLD FRANKLYN, KCB, DSO, MC. REPRODUCED, WITH THE ILLUSTRATION, FROM THE BRITISH ARMY JOURNAL BY PERMISSION OF THE CONTROLLER OF HIS MAJESTY'S STATIONERY OFFICE.

The soldier in battle, unlike the civilian, has no set hours of work but must be capable of working and maintaining a high mental pitch for many hours on end, despite all adverse conditions of hunger, weather, lack of sleep and physical exhaustion. This characteristic can be cultivated only by careful training, which must be started the moment he joins the Army and continue throughout his service. On his first day he must enter an atmosphere which is thoroughly alive, for alertness can grow only in stimulating surroundings.

Brighter Barracks

A great deal can be done by units to liven up grim-looking barracks and camps by painting the outside of window frames in a bright colour and improving rooms with gay curtains, tablecloths and lamp shades; gardens, brightly painted railings, coloured notice boards, unit and sub-unit flags and even white stones all help to produce a cheerful and stimulating atmosphere. It is more important that colour schemes should be arresting rather than artistic. Boredom leads to all manner of trouble, so all its causes must be eliminated. Except during comparatively short periods of intensive training, it was customary during the period between the two wars to do very little real work in the afternoons, with the result that many men were at a loose end from dinner till lights out. As a rule not more than a small percentage played games owing to lack of sufficient recreational facilities. There are, however, many games which do not need large and well-kept grounds, and the idea that games are for the few and not the many must be eliminated. Tennis, Deck-Tennis, Basketball, Net-ball, Quoits, Skittles, Bowls, Handball, Tug-of-war and the field events of athletics can all be practiced in confined spaces. Every man must take some form of exercise on at least four afternoons each week;



he must not be allowed to loaf or sleep.

Simple Amusements

After dusk a soldier usually has to choose between the delights of the local town, a rather dull institute, or sitting on his bed in a barrack room. When he has little money in his pocket the choice is even more restricted. This state of affairs is utterly wrong and is a survival of the times when a soldier would be quite happy on most evenings swilling beer in the canteen. Every barracks should have facilities for reading, writing and every type of indoor game; cinema shows, dances, debates, handicrafts, theatricals, concert parties and musical evenings must be organized. There should be much more boxing, wrestling, fencing, gymnastics and swimming by artificial light. The miniature and pellet ranges can be more fully employed for interesting competitions. Above all, barrack rooms must have good lighting with sufficient chairs and tables to permit every man to read and write in comfort.

Having provided in this way for a fully organized day in cheerful and lively surroundings, care must be taken to maintain a brisk tempo during work hours. There must be no hanging about or undue waiting for the next item to begin; far too much of a soldier's life is spent in waiting, and this can be avoided by a little organization by his superiors. Officers must appreciate what harm they are doing when men are kept queuing up for an interview, to see the doctor, for orderly room or to draw equipment from the Quartermaster's Stores. They are merely encouraging loafing. The speed and tempo of modern war calls for continuous alertness, so every unforgiving minute must be usefully filled in its stimulation.

140 to the Minute

Actual speed of movement on and off parade is a factor in developing alertness. There is a great deal to be said for the Light Infantry pace of movement, but even if this is not generally adopted, it is advisable that recruits should be drilled at high speed for the first few weeks so as to set them alight. The good done on the parade ground will soon be undone if men are afterwards allowed to slouch about barracks. The soldier must always move in a smart manner, both at work and off duty, and officers and NCOs must be an example in this respect.

Employment and fatigues must be carefully organized. Batmen, waiters, storemen, groundsmen and the like must be pooled to ensure that all employed men have full a day's work and avoid any of their time being spent in loafing.

Paint the Picture

A man will always have to do a

proportion of dull, slogging work to the detriment of his alertness; when men are actually training, therefore, not a moment must be wasted and all instruction must be full of life and interest.

To deal first with collective training: the bigger the exercise the duller it is for the man in the ranks. Usually even junior officers and NCOs have only the vaguest knowledge of what is really happening and the men naturally have even less. In collective training there cannot be the same excitement as in war, but there is less excuse for ignorance as to what is happening. Before a large-scale exercise begins, care should be taken to ensure that everyone is put in the picture and kept in it each day by communiques, unit news sheets or broadcasting. At the end of the exercise the director should broadcast to all ranks a summing up, emphasizing the principal lessons and awarding praise where justified. In addition, of course, commanders of all grades must pass on to their juniors a narrative of events with full criticism, using pictures when possible. What is needed to keep everyone *au fait* in the big-scale exercise is equally necessary in the smaller ones, but such elaborate methods can be dispensed with.

Avoid a lot of short exercises. It is much better, at every stage of collective training, to have a few long schemes with plenty of time between each for conferences on the previous one and preparations for the next. Individual training can usefully be sandwiched between the exercises, thus affording an opportunity to correct those mistakes in elementary training which have become apparent during the exercise. In any case it is a mistake to divide individual and collective training into water-tight compartments.

Interesting the Individual

As the name implies, individual training must ensure the maximum amount of instruction for each individual. The first step therefore is to ensure that squads are as small as possible for those subjects which demand the maximum of individual attention, so economize instructors on those items where a few can handle large squads, thus making a pool of instructors available for subjects where small squads are essential. However, even with this elastic organization squads will seldom number less than eight, a disadvantage which can be partially overcome by ensuring that there is a weapon, or piece of equipment, to every man, or at least to every two men. In this way every pupil will be handling practically all the time, even when the instructor is talking, or else he must act as critic of another man who is working; a critic should not be a mere spectator and he must always be asked

to give his criticism. Sometimes the instructor should give a demonstration and make deliberate mistakes: this device will wake up the sleepiest squad as no man can resist the chance to catch teacher out.

In all arms of the service there are various tests which a man has to undergo periodically; many are issued by the various War Office schools, but even so units must devise additional minor ones. A man should always have a test, or group of tests in front of him, on which he can rivet his attention. Tests give a boost to individual training and keep it lively and should eliminate the bugbear known as "Revision". The repetition of complete lessons saves the instructor from having to think; it is always wrong and kills keenness. "Quiz" competitions will often expose unexpected weaknesses: it is probable that nothing else is so invigorating to training as competitions; men never seem to weary of them. The most useful ones are those embracing a wide range of subjects spread over a week or more and when every man contributes to the score of his sub-unit or team. The results obtained can well form the basis of these larger scale competitions.

Novelty acts as a tonic to training and breaks monotony. Men must never be kept standing in the same position for long; modern PT instructors fully understand this and constantly shift men around. A sudden burst of physical exercise will wake men up and re-focus their attention on a dull lesson.

"On your Marks"

In their very earliest lessons at drill recruits are taught to stand to attention. Although a state of complete physical immobility is insisted upon, the necessity of minds being keyed up and ready for instant action may not be sufficiently emphasized. It is doubtful whether the mind can be completely alert unless the body is potentially active and the position of attention, which is apt to become wooden, may not be the best for instant mental reaction. Just before the start of a sprint race the competitors "Get Set"—an extreme example of potential physical activity. The normal position of attention can be made to serve this purpose if properly used. A device to ensure good drill is that the executive word of command should be preceded by a precautionary word, and although this device certainly improves drill, it is not conducive to alertness, for men realize that until the precautionary word is given they can allow their minds to relax. The trained soldier should be able to drill, and drill well, on the tap of a drum without any precautionary roll or on a signal from the instructor or even by a tap on the back. In this way the senses of hear-

ing, sight and feel are all brought into play and the climax of this branch of training in alertness should be when the soldier is ready to act on any of these methods of giving an order without foreknowledge of which it will be.

The next step is to reach instant reaction to what is seen or heard in the field. The preliminary steps of this training can be by means of games and competitions. The children's game of "Musical Chairs" is an example of immediate reaction to cessation of sound, i.e., when the music stops. This game can easily be adapted and given a more military setting; "O'Grady" is an example of this.

Various forms of "Quiz" can be used not only as a test of knowledge but also to stimulate the mind. Towards the end of a period, when several squads have been learning the same lesson, it is a good plan for supervising officers and WOs to collect the squads in pairs and test what they have learnt by means of a Quiz competition between each pair of squads, an order of merit can be arrived at for all of them. Incidentally such a competition will give a good line on the relative value of the instructors.

Learn to Look and Listen

It has for long been the custom to spend some time on developing men's powers of observation by both eyes and ears; in its elementary stages this training should be done with the squad standing and with easy targets: later the targets should be made more difficult and the observers should be lying behind cover for longer periods.

Demonstrations of the sound caused by the various military weapons, including as many foreign weapons as possible, and of the crack and thump of the rifle bullet must be given, as well as practice in picking up sound and diagnosing it. Later still practice should be afforded in observation combining sight and sound both by day and by night.

No one needs to be more on the alert than a sentry. A sentry on guard duty in peacetime has too little in common with a sentry on active service and yet the former should be a preparation for the latter. The main difference is that whereas the unexpected so rarely happens to a sentry on guard duty, on active service the lives of his comrades depend on the quick reactions of a sentry to surprise. There must be a better link up between the two types.

It is comparatively easy to observe when stationary, but more difficult to do so when moving, for then a man is distracted by picking his way, and the rougher the country the less easy it is to observe. When on the move a soldier is much more vulnerable than when stationary and alertness, which enables him to see his enemy before he is seen, may become a matter of

life or death. Good practice can be obtained in this difficult type of observation by making two men advance towards each other through close country and the one who first fires an aimed round of blank at the other is accounted the winner. This exercise is harder and more practical if done walking rather than crawling.

Individual Battle Practice

The best way of teaching alertness is by means of individual battle practice. The man must be left entirely to his own resources and he should have no idea beforehand where the targets will appear. As an introduction to teaching alertness in this way the miniature range can be used for a defence practice: targets should be pulled up slowly and quietly in unexpected and different places. A similar practice can be carried out on the classification range with bushes arranged on the mantlet to afford some cover for the exposure of targets. More advanced tuition on these lines is afforded for this type of practice by a field firing range where there is more scope for varying and concealing targets. The hardest and most practical training, however, is when a man has to advance taking on unexpected targets whilst on the move under all conditions of light and weather: rifle, submachine gun or pistol can be used and, if the danger area is restricted, quite good value can be got by using miniature ammunition.

In some battle practices it is an advantage to produce a few targets which represent friendly troops and so must not be fired on. A man who thus has to select which targets to engage is kept even more on the *qui vive* than if allowed to fire at anything seen.

Eliminating the Dormant Mind

Alertness is of extreme importance for the man in the ranks but is even more so for leaders of all grades. However self-reliant and knowledgeable a leader may be, he cannot use his initiative if he does not recognize chances until they have come and gone. Success in battle depends so largely on the initiative shown by the junior leaders. The dormant mind, moreover, is at the mercy of the unexpected, whereas the leader who is always thinking ahead is much less likely to be surprised. Further, the hesitant character is helped to make decisions if foresight enables him to realize what sort of decisions he may have to make and when. . .

Finally, the methods advocated here for developing alertness depend for their success upon the enthusiasm of officers and NCOs from the Commanding Officer downwards; however painstaking the instructor, he will not get good results in a dull or listless atmosphere. Once a pupil has really learnt to be alert, he can learn anything.

HOW TO DETECT RADIOACTIVITY

By
H. J. Duffus, Lecturer in Physics,
Carleton College, Ottawa

Atomic energy sets for children are now on the market. This is fair warning that one cannot for long keep the respect of the younger generation with only a rather general knowledge of meccano sets. The "Atomic Age" is here as surely as the television set, and every red-blooded man needs the same nodding acquaintance with atomic energy as he now has with the engine under the hood of his car.

One of the difficulties in becoming familiar with atoms is that unlike your car they can't be seen or touched directly. One way of "touching" them is with the Geiger-Müller counter (one in each and every atomic energy set). However, there are a number of other techniques used by scientists to measure atomic reactions. They depend upon the ability of the radiation from atomic disintegrations to knock electrons away from atoms with which the radiation collides. An atom from which an electron has been removed is called an ion (Fig. 1).

The earliest method of detecting radioactivity was that used by Henri Becquerel when he discovered the phenomenon. By chance he left a lump of an uranium ore upon an unexposed photographic plate. When later he developed the plate he was puzzled to find that it had been ruined. To verify his theory that the ore had given off a radiation capable of penetrating the thin black paper which covered the unexposed photo-

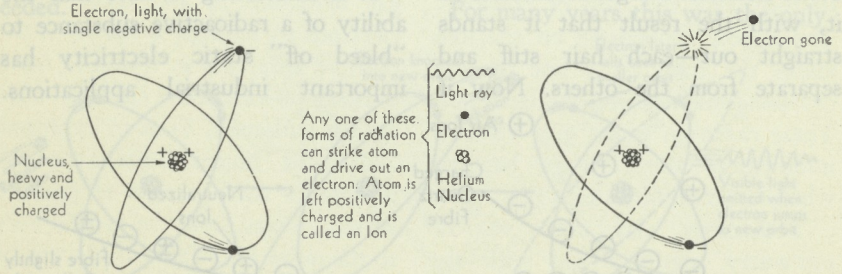


Fig. 1

graphic plate, he again placed the ore above an unexposed plate . . . but this time he put a metal key between them. The image of the key appeared when the plate was developed. The image appeared because the ions produced by the radiation from the ore formed a black deposit of silver when the plate was developed. Where the metal key shielded the plate from the radiation no ions formed, and the plate beneath the key was clear when developed.

This photographic technique is still extensively used both in research and in controlling the hazard of radiation poisoning. As a safety measure, workers using radioactive materials carry small pieces of photographic film pinned on their clothes. The extent to which the developed film is blackened indicates the amount of radiation which has fallen upon the worker.

Ionization chambers are also used. Everyone knows what happens to his hair when it is combed on a dry day. Static electrical charges accumulate on it, with the result that it stands straight out—each hair stiff and separate from the others. Now if a lump of uranium ore were brought near this erect charged hair it would collapse. The explanation is simple. If an accumulation of static electricity caused the hair to stand on end, then it should collapse when the charge leaks off. The radiation from the uranium speeds up the leakage by creating air ions near the hair. These charged ions are attracted to the oppositely charged hair and neutralize it. Thus the accumulation of charge is quickly destroyed.

The ionization chambers carried by research workers using radioactive materials rely on much the same mechanism. Instead of hair, however, a tiny quartz fibre is enclosed in a metal chamber. The fibre is given a charge of electricity and, like the hair, arches away from its support. However, if radiation falls on the chamber, the charge on the fibre is neutralized by the ions created, and the fibre collapses. The extent of its collapse is a measure of the radiation which has fallen on it (Fig. 2).

It is interesting to note that the ability of a radioactive substance to "bleed off" static electricity has important industrial applications.

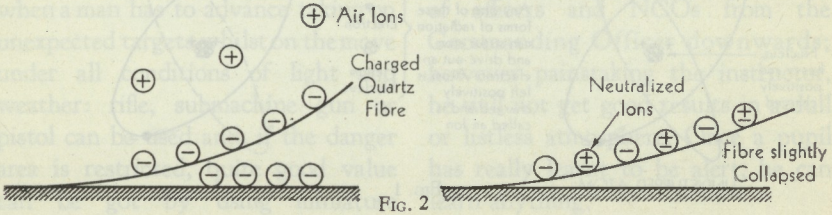


FIG. 2

Printing presses, for example, develop large static charges. Printers who had to touch the machines received shocks, and the printed sheets would not pile easily as they came from the press. Occasionally serious fires were started when sparks ignited the inflammable ink. All these inconveniences can be overcome by placing radioactive bars in the presses. The author foresees a useful application of these newly available radioactive metal bars in handling explosives, where there is some danger of explosions being set off by static electricity.

To return to the story of radiation meters . . . we must note that neither the photographs nor ionization chambers give us much information about what is happening to a single atom. Rather, they give information about the total quantity of radiation which is produced during a given time. While this is useful, it is not enough to satisfy the curiosity of scientists. A method of "observing" the disintegration of a single atom was needed.

It was known that the radiation from atomic disintegrations caused certain solids to fluoresce. The same materials now used on the luminous screens of radar scopes and television sets were used to detect radiation. The mechanism of detection again depends upon the ability of the radiation to knock an electron out of an orbit . . . but now we can directly observe the light the electron gives out when it falls back to another stable orbit in the atom (Fig. 3).

At McGill University, Lord Rutherford investigated not only the radiation from radioactive substances but also the properties of the nucleus of the atom itself. He performed this monumental work largely by painstaking observations of the tiny scintillations which occur when radiation strikes a zinc sulphide screen. (If you are interested in the difficulty of this task try watching the scintillations of your luminous wrist-watch dial under a good magnifying glass).

For many years this was the only

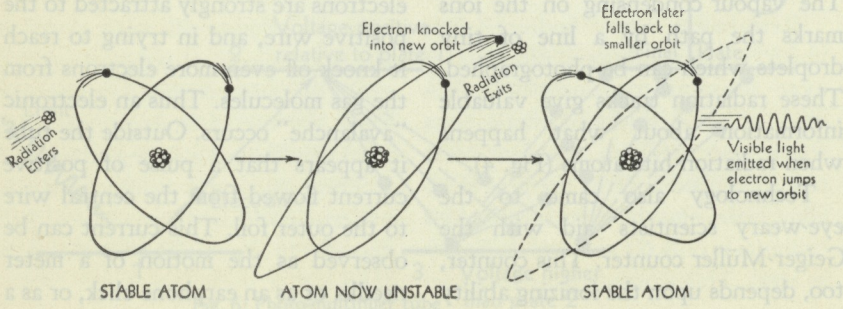


FIG. 3

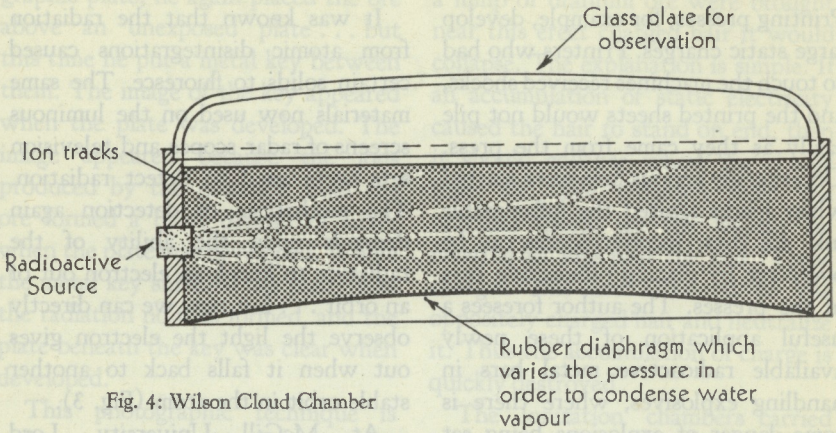


Fig. 4: Wilson Cloud Chamber

technique available — a technique limited by the accuracy and endurance of the observer's eye.

Relief came in the form of the C.T.R. Wilson Cloud Chamber. It was discovered that mist or fog condenses on dust particles or charged air molecules (i.e. ions). Wilson constructed a dust-free chamber containing some water vapour. Under proper conditions this vapour can be condensed upon the ions in the chamber . . . and these ions are formed along the path of radiation. The vapour condensing on the ions marks the path by a line of tiny droplets which can be photographed. These radiation tracks give valuable information about what happens when radiation hits atoms (Fig. 4).

Technology also came to the eye-weary scientists' aid with the Geiger-Müller counter. This counter, too, depends upon the ionizing ability of radiation. A common design of counter tube is shown on page 31.

The tube consists of a central wire maintained at a high positive voltage relative to the concentric cylinder of metal foil. The whole is enclosed in a glass tube and evacuated to a low pressure. In the absence of radiation there is no electrical current between the central wire and the foil. However, when a radioactive source is brought near the counter the radiation will dislodge some electrons from the gas molecules in the tube. These electrons are strongly attracted to the positive wire, and in trying to reach it knock off even more electrons from the gas molecules. Thus an electronic "avalanche" occurs. Outside the tube it appears that a pulse of positive current flowed from the central wire to the outer foil. This current can be observed as the motion of a meter needle, or as an earphone click, or as a

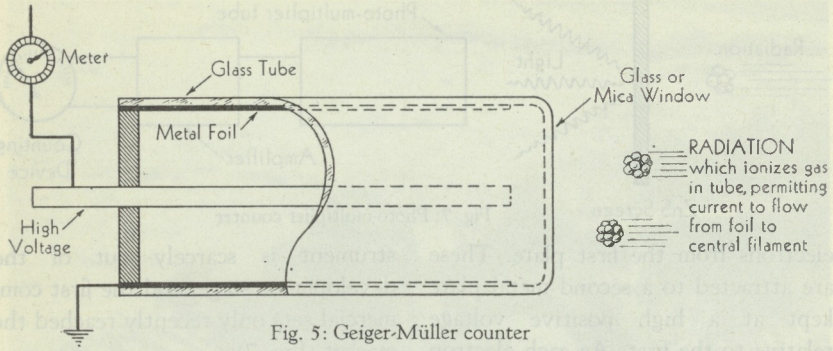


Fig. 5: Geiger-Müller counter

blip of current on an oscilloscope screen.

The usefulness of the Geiger-Müller counter is limited by several factors. The radiation must enter the tube not only through a finite thickness of glass or mica, but also from a very limited region of space outside the tube. Furthermore, scientists want to measure separate radiations arriving almost simultaneously. The tube, however, is not ready to register the second radiation until the electrons from the first avalanche have reached the central wire. The fact that this requires only about a millionth of a second did not satisfy our impatient scientists. They wanted something better.

Again technology came to the rescue of our eye-weary and impatient scientists. While the old zinc sulphide screens were gathering dust, and people were zealously learning to blow glass tubes, the radio industry had started to manufacture photo-multiplier tubes.

Now these tubes play the same sort of game as do the Geiger-Müller counters, but they start with visible light instead of invisible radiation. The visible light knocks loose a few

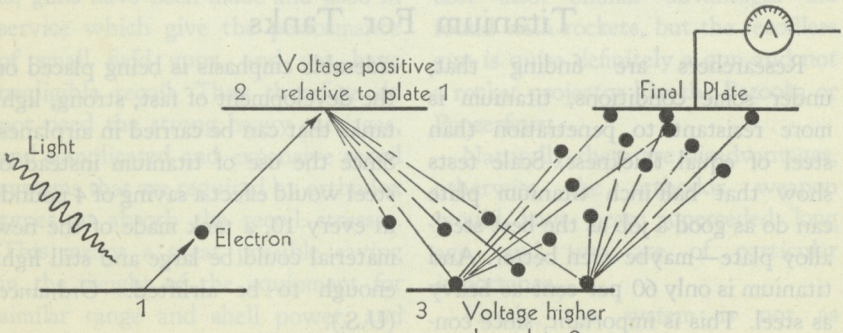


Fig. 6: Photo-multiplier tube

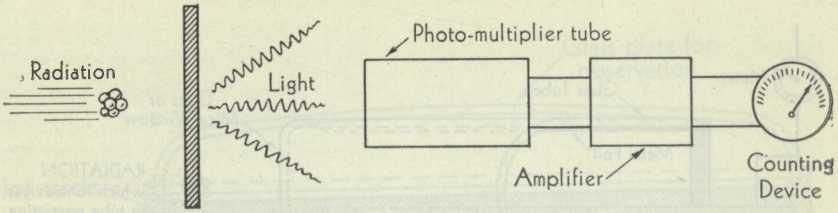


Fig. 7: Photo-multiplier counter

electrons from the first plate. These are attracted to a second metal plate kept at a high positive voltage relative to the first. As each electron strikes this plate it knocks loose about a hundred more electrons. These in turn will be attracted to another plate, and so on. This process is repeated perhaps twenty times until instead of the original electrons we have an easily measurable pulse of current (Fig. 6).

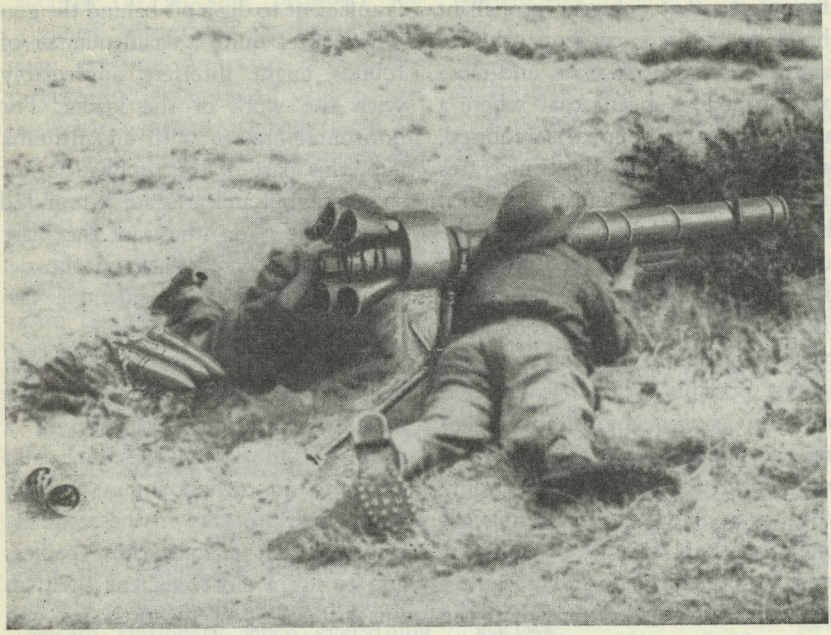
Recently this useful tube has been used to measure automatically the scintillations of a zinc sulphide screen. The device, called a crystal counter, or a photo-multiplier counter, is faster and sturdier than the Geiger-Müller counter. However, the instrument is scarcely out of the development stage, and the first commercial sets only recently reached the market (Fig. 7).

These, the photographic plate, the ionization chamber, the Wilson Cloud Chamber, the Geiger-Müller counter, and the photo-multiplier counter, are the tools of the research worker and the health control officer. We may again see these instruments go through a cycle of improvement. However, the mechanism of ionization will probably remain the fundamental process by which we detect the presence of radioactivity.*

* For further information on radiation see *The Atomic Bomb*, Canadian Army Journal, Vol. 3, No. 3, June 1949, P. 17.

Titanium For Tanks

Researchers are finding that, under some conditions, titanium is more resistant to penetration than steel of equal thickness. Scale tests show that half-inch titanium plate can do as good a job as the best steel-alloy plate—maybe even better. And titanium is only 60 per cent as heavy as steel. This is important, since considerable emphasis is being placed on the development of fast, strong, light tanks that can be carried in airplanes. Since the use of titanium instead of steel would effect a saving of 4 pounds in every 10, a tank made of the new material could be large and still light enough to be airlifted.—*Ordnance.* (U.S.).



RECOILLESS GUNS

By Major N. H. Wood, Royal Artillery.

The recoilless gun is a fact. That is, guns have been made and used in service which give the performance of small field guns, and yet have negligible recoil. They therefore do not need the strong heavy carriages, and complicated and expensive recoil systems that are required by orthodox types to absorb the recoil stresses. This means a great possible saving in the weight of the equipment for similar range and shell power, and since weight means money, in the cost also. Similar advantages are found with rockets, but the recoilless gun is quite definitely a gun and not a rocket projector like the Bazooka or Panzerfaust.

Naturally there are disadvantages, otherwise the orthodox weapon would have been superseded long ago, and two are of particular importance.

Firstly, the system is not as

efficient, so that a bigger propellant charge is required: consequently the cartridge is larger, heavier, and more expensive. This means that where a large number of rounds is required, as with a field gun, these increases in each round are multiplied until the saving in weight and cost of the equipment is outweighed by the extra weight and cost of the ammunition. Only where small individual loads are essential and therefore the lightest possible weapon is required and any consequent disadvantages are acceptable, does the recoilless gun appear to show an overriding advantage. Airborne operations or jungle warfare spring to mind at once as possibilities, and recoilless guns have already been used in the late war in these roles.

Secondly, when the gun is fired there is a backward blast and flash which is greater than that from the muzzle. This means that there is a danger area of considerable size behind the gun, making its siting and servicing more difficult, and increasing greatly the concealment problem once it has opened fire. Obviously if circumstances demand it in war this disadvantage can be accepted, but it is inherent in the way the gun works, and the more powerful the gun the worse the backblast becomes. With a gun equivalent to the 25-pounder firing at medium elevations on normal downland the backblast is sufficient to dig a pit behind the gun which after quite a small number of rounds might interfere appreciably with the work of the loader. For horizontal fire, as with an anti-tank gun, this part of the problem is not so severe, but a clear space is required behind the gun, otherwise the blast would be reflected back on the detachment to their considerable discomfort, to say the least of it.

Contrary to some widely held beliefs, there is no theoretical limit to the size or performance of a recoilless gun that does not also apply to an orthodox gun. Nor is there some property in the recoilless principle that enables the recoilless gun to fire a more efficient shell; in this latter respect the orthodox gun can do all that the recoilless gun can do, and still be more efficient in the use of propellant.

The advantages of the recoilless gun appear to be most marked, however, in the smaller sizes. As an example, if a recoilless weapon for field artillery use is so large that it has to be towed, parts of the carriage have to be just as strong and heavy as for an orthodox gun in order to stand the towing stresses. Thus though the weight and cost of the recoil system is still saved a large part of the weight reduction possible in the rest of the carriage is lost. Also since the weight of the gun increases disproportionately with

increase in working pressure, the greatest advantages are found with low pressure weapons. Both these arguments favour small calibre, low velocity weapons, though guns up to 16-inch calibre have been made and fired experimentally.

How It Works

If we have a smooth bore gun barrel open at both ends, and load into the middle of it two identical projectiles P_1 and P_2 with a charge C between them, and fire the charge

FIG. 1

the two projectiles will go out in opposite directions and the gun will remain stationary since everything that can make it recoil in either direction is exactly balanced. This is the countershot principle and is the basis of the action of the recoilless gun: i.e., that something is shot backwards which balances the effect of shooting the projectile forwards. The charge is approximately twice that required for an orthodox gun, since two projectiles are fired and divide the energy between them.

If now the weight of the projectile P_1 is reduced and the gun fired again P_1 will go out faster than P_2 but if there is no friction between projectiles and bore the gun still will not move. If there is equal friction and we load the gun so that the two projectiles are ejected at the same time the gun is still balanced and will not move.

If now we reduce P_1 to nothing, the gun will still not recoil if there is no friction, though P_2 will go out considerable slower than in the first case; i.e., the gun is not so efficient and a much larger charge is required to get the original velocity. Any friction between P_2 and the gun will now make the gun "recoil" forwards!

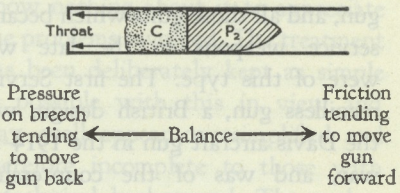


FIG. 2

This can be balanced by reducing the size of the bore at the rear, forming a throat so that the gas pressure acting in the direction of the arrows (Fig. 2) opposes the friction and the gun can still be made recoilless. It is still not as efficient as it might be.

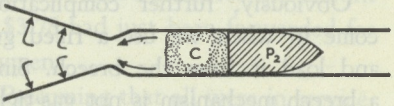


FIG. 3

If now we expand the rear end of the gun in the form of a cone and smooth off the interior to give streamlined gas flow, the efficiency of the

gas jet is considerably increased. The pressure of the gas filling the cone is acting in the direction of the arrows at right angles to the face of the cone. These arrows are pointing forward slightly and therefore the gas tends to move the gun forward, so we require a still greater reduction in the size of the "throat" to maintain balance. This means that less gas is lost to the rear, a smaller charge is required, and the efficiency of the gun is increased.

This very simply is the general basis of the "Jet" type of recoilless gun, and all those guns which became service weapons in the late war were of this type. The first Service recoilless gun, a British design, was the Davis aircraft gun in the 1914–18 war, and was of the countershot type, the rear projectile being a charge of small shot. Naturally a gas jet is less dangerous than a second projectile to anyone behind the gun, and this is an obvious advantage, though the countershot gun is rather more efficient than the jet gun, in the use of the propellant.

Obviously, further complications come in when we use a rifled gun and load it from the breech. Since a breech mechanism is not gas-tight, and would be damaged by gas leakage through it, this must be prevented. Obturation, i.e., a sealing device, must therefore be provided as in a normal gun, with the complication that there must be a free passage for the gas backwards to the jet nozzle and nowhere else; the obturation may be of either quick-firing (cartridge case) or breech loading type.

With a single central jet the gas must pass through the obturator and breech mechanism, and the firing mechanism and primer must either be in the path of the gas, or at the side, all of which introduce further problems in design. This can be avoided by using multiple nozzles coming directly from the chamber around the breech mechanism, which can then be of normal design. These nozzles are, however, more fragile than the single central nozzle, and for maximum efficiency and normal chamber diameter the gas passages cannot be straight, introducing erosion problems at the bends. However both types can be made to work.

Since practice never follows theory exactly, and no two rounds are exactly the same, it cannot be expected that the gun will ever be perfectly balanced and some stresses on the mounting are bound to occur. Usually, and particularly where the jet is always open as in Fig. 3, the gas jet starts before the projectile and the gun begins to move forward. When the projectile moves the gun is designed to recoil backward by a similar amount, so that there are two equal kicks first forward and then

backward. The whole action is over before any appreciable movement can take place, but if the gun is rigidly mounted the stresses on the mounting may be high. If the mounting is very light and free to move these stresses are greatly reduced, and it is perfectly possible to design a gun which could project a shell as powerful as a 25-pounder and be fired from a man's shoulder with less kick than a Service rifle: the range however would not compare with that of the 25-pounder.

German designers attempted to overcome the double kick effect by closing the jet with "bursting disc" designed to burst at the same pressure at which the driving band engraves and the projectile starts to move, so that projectile and gas jet start together. In theory this makes for better balance, but it is not easy to ensure that the bursting disc breaks at exactly the right pressure and the pieces of the disc increase the danger of the backblast. Both this system and the open jet type have, however, worked satisfactorily in practice.

It can be seen, therefore, that the recoilless gun, though it has undoubted advantages, has also considerable drawbacks, both from the point of view of user and designer. It is hoped that the foregoing description will have helped those who know nothing about it to appreciate the problems involved. The treatment has been deliberately kept as simple as possible with this in view and may well appear oversimplified and therefore incomplete to those with a technical background. The author craves their forbearance.

Building Up Regimental Funds

In February 1906 the Officer Commanding the 87th Quebec Regiment (now Le Régiment de Quebec (Mitrailleuses) forwarded to Ottawa one box containing 2720 small buttons, with an official letter saying that he hoped these would be found in serviceable condition and requesting that an amount equal to one half the original cost be remitted for his regimental funds. Having received no reply, some two months later he forwarded a copy of his original letter through Headquarters, Military District No. 7, and Quebec Command. This elicited from the Office of the Quartermaster General an acknowledgement that a claim for the amount of $3.78 had just been forwarded for payment.

Presuming that all were in serviceable condition, these 2720 small buttons therefore yielded a little more than one-tenth of a cent each for the regimental funds.—*Contributed by the Historical Section from Dept. of National Defence files.*

CANADA
AND THE SOUTH AFRICAN WAR

By
COLONEL C. P. STACEY, OBE, DIRECTOR OF THE HISTORICAL SECTION,
ARMY HEADQUARTERS, OTTAWA

III. The Canadian Regiments in South Africa

Last week I spoke of the raising of the Canadian Contingents that went to South Africa. Today I want to say something about what they did on the battlefield.

First of all, just a word about the course of the war in a general way. I said that the British found the Boers a lot more formidable than they expected. This disillusionment set in at the very beginning. Right after the declaration of war the Boer commandos rode over the border into Natal and the Cape Colony and beat the British forces that were on the ground. The British found themselves blockaded in three towns—Kimberley, Mafeking and Ladysmith; and the Boers, instead of cantering on to Cape Town, sat down to besiege them.

Siege warfare was just what the Boer mounted infantry were least fitted for—even though they did have a good corps of professional artillery to help them. So the commandos didn't take any of the three towns. But when troops pouring in from England tried to relieve them the Boers gave them a very rough time. December of 1899 brought the "Black Week", when three British columns suffered bloody defeats within six days.[1] Now England sent out the best generals she had. In January Lord Roberts, legendary little "Bobs" whom every subject of the Queen knew and trusted, arrived at the Cape. With him as his Chief of Staff came Lord Kitchener of Khartoum. It was at this stage that the First Canadian Contingent came into action.

Colonel Otter's battalion of the Royal Canadian Regiment had been

[1] *General Gatacre's force at Stormberg, 10 December; General Lord Methuen's at Magersfontein, 11 December; General Buller's at Colenso, 15 December.*

This is the third of four scripts written by Colonel Stacey for a series of broadcasts which he delivered over a Canadian Broadcasting Corporation network earlier this year to commemorate the 50th anniversary of the South African War. By permission of the author and the CBC, the Journal is privileged to publish the series. Part IV, "The War in Canadian and Commonwealth History", will be published in the next issue.—*Editor.*

kept on the lines of communication for a couple of months. This was certainly just as well, for the battalion had left Canada without the men in it having time to get to know each other—to say nothing of getting any training. Even as it was, it went into a first-class battle almost exactly four months after the orders were given to recruit it. This seems extraordinary nowadays, when we think of an infantryman as needing a year's intensive training. But weapons and tactics were a lot simpler half a century ago.

Towards the middle of February 1900, Lord Roberts launched his offensive. He said good-bye to his base and with four divisions set out on a great turning movement against the communications of the Boer General Cronje, whose army was blocking the way to Kimberley. The Royal Canadians went with him. They were now part of the 19th Brigade, whose other battalions came from the Duke of Cornwall's Light Infantry, the King's Shropshire Light Infantry, and the Gordon Highlanders. The brigadier was Major-General Horace Smith-Dorrien, who is best remembered as a famous Corps Commander in the Retreat from Mons in 1914.

Roberts' plan succeeded. General Cronje, apparently, had been expecting a frontal attack. Roberts' blow at his communications took him off guard and before he could get away he was pinned down at Paardeberg Drift on the Modder River. His men dug in and held grimly on; and the ten days' nasty fighting that took place before they gave in is known as the Battle of Paardeberg. On the first of these days, the Canadians' first day of real action, they got involved in a foolhardy charge across the open. The actual order for this came from the Cornwalls' colonel, though Kitchener himself may have been at least partly responsible. All it accomplished was the death of a good many men, including over a dozen Canadians (and the Cornwalls' colonel).

The 27th of February, the last of the ten days, was Majuba Day—the anniversary of the British defeat by the Boers back in 1881. And it was the Canadians who delivered the final attack on the Boer trenches that wiped out that bitter memory. There were to be no further daylight charges in the face of those deadly rifles. The plan called for a silent night attack designed to take the Boers by surprise.

Soon after two in the morning the R.C.R. and a party of Royal Engineers climbed out of their own trench and moved quietly forward under the stars. They had 550 yards to go. There was no sound except the stealthy shuffle of booted feet, the creak of equipment and the heavy breathing of anxious and excited men. They covered half the distance, and still there was no sign of life in the

Boer positions. Three hundred yards. Four hundred. Four hundred and fifty—and the silence was shattered by two rifle shots. Almost on the instant the whole Boer trench was a flickering line of fire. A number of the Canadians fell dead or wounded; the rest threw themselves flat. The nearest men were only 65 yards from the Boers. The front rank returned the fire, the rear rank began to dig. Later in the night, somebody (perhaps a Boer) shouted an order to fall back, and some of the companies obeyed it; but two of them stuck to the new trench, and at dawn they were still there, within a hundred yards of the enemy. A couple of hours later Cronje and his 4000 formidable riflemen put up the white flag. He seems actually to have made his decision to surrender *before* the Canadian attack; but if there was any doubt in his mind that night's work removed it.

The ten days of Paardeberg cost the Royal Canadians over 130 casualties, including 34 men killed or died of wounds. It was the first overseas battle ever fought by the Canadian Army; it was the biggest and bloodiest battle that Canada fought in this war; and it ended in a victory that was a wonderful ray of sunshine for an Empire that had had nothing but bad news from South Africa for months. It was followed in short order by the capture of Bloemfontein, the capital of the Orange Free State. Ladysmith and Kimberley had both been relieved, and Roberts marched on Pretoria, the Transvaal capital. In June 1900 he took it as well. In these victories the Royal Canadians, now marching and fighting under Ian Hamilton's command, continued to play an arduous part, though they were never so heavily engaged as at Paardeberg. Men from the Second Contingent were now in action too. "C" Battery helped relieve Mafeking in May.

With the capitals of the two Boer republics in British hands, Lord Roberts shortly went home, leaving Kitchener in charge. And a great many people jumped to the hasty conclusion that the war was over. But it wasn't; it went on nearly two years longer. The fact is that it simply didn't occur to the Boers to stop fighting just because Pretoria and Bloemfontein were gone. What happened was that the war went into a new phase—a guerilla phase. Instead of trying to maintain large field armies, the Boers now worked with small bodies of horsemen, harrying the British communications, making lightning attacks and withdrawing before large forces could concentrate against them. The British countered these by using mobile columns capable of playing the Boer game. But the problem was difficult, and in the last stages of the war they found they had to build and garrison thousands of

blockhouses for defence against the commandos. What was more, they moved many Boer women and children into "concentration camps" so that the farms would no longer be bases for the guerillas. Needless to say, these weren't "concentration camps" in the Nazi sense. All the same, they caused great bitterness and many hard words were said about them in England.

In the early stages of this guerilla phase of the war the Canadian mounted troops had plenty to do. The Royal Canadian Dragoons and the Canadian Mounted Rifles, and the three artillery batteries, all reached South Africa early in 1900. Strathcona's Horse weren't far behind. It would take a long book to tell the whole story of the Canadian battles that year. I can only mention one or two incidents.

One story *must* be told. It is that of the rearguard action at Leliefontein. In November a column under General Smith-Dorrien, including both the R.C.D. and the C.M.R. as well as a section of "D" Battery, was operating in this region of the Eastern Transvaal. On the 7th[2] it found itself beset by great masses of Boers and had to retire. Sickness had reduced Colonel Lessard's Dragoons to a handful, but it fell to them and two of "D" Battery's guns under Lieutenant E. W. B. Morrison to cover the Infantry's retreat. The Boers saw the troops withdrawing, and in Smith-Dorrien's words "an event unprecedented in this war occurred". Several hundred of the burghers jumped on to their horses and charged the rearguard, firing wildly from the saddle. A small detachment of dismounted Dragoons under Lieutenant H. Z. C. Cockburn protected the retiring guns, fighting until all but six of the men were killed, wounded or captured. The guns struggled on, but the horses pulling one of them, completely played out, came down to a walk; and there was nothing for Morrison to do but yell "Action Rear", get his gun-trails down and start shooting. The little 12-pound shells bursting under their horses' noses checked the Boers in front, but those on the flanks still came on. The guns limbered up and again began to crawl away, the gunners pulling on the traces with the horses. Another party of Dragoons under Lieutenant Turner sacrificed itself to cover them; and in the nick of time Colonel T. D. B. Evans' Canadian Mounted Rifles galloped up to help. The guns got clear and the column made good its retreat to its base.

That was a great day for the Royal Canadian Dragoons, for it brought them three Victoria Crosses. They went to Lieutenant Cockburn and Sergeant E. J. Holland, and to Lieut-

[2] *The date 12 November on the gun in Confederation Square, Ottawa, is an error.*

enant R. E. W. Turner—who was to command a Division in the 1914 war and is now Lieutenant-General Sir Richard Turner of Quebec City.[3] Morrison got a well-deserved D.S.O. and lived to be Major-General Sir Edward Morrison and to command the Canadian Corps Artillery in 1916-18. And Morrison's guns, saved by the expenditure of so much good blood, came home to Ottawa;[4] and one of them stands today in Confederation Square, among the red streetcars and the hurrying civil servants, to recall brave deeds done under the sunny skies of the Transvaal, half a century ago.

The one other Canadian V.C. of this war went to Strathcona's Horse—which the British Official History warmly describes as "a body of Canadian rough-riders unsurpassed for daring and endurance in the field". In a skirmish in July 1900, while the Regiment was serving in Lord Dundonald's 3rd Mounted Brigade, Sergeant A. H. L. Richardson's troop was retiring when one of his men was wounded and left behind. The sergeant turned back under very heavy fire, picked up the wounded man and carried him off to safety.[5]

New units came in from Canada late in the war: 1200 men for the South African Constabulary; a 2nd Regiment of Canadian Mounted Rifles; a Field Hospital Company (and eight Nursing Sisters besides); and finally four more regiments of Mounted Rifles, which got to South Africa only after the war was over. All these were recruited by Canada for the British Government, which paid the whole of the cost.

The 2nd Regiment of Mounted Rifles is particularly remembered for an episode on its first day in action. In this fight, at Boschbult in the Western Transvaal, 21 men of the regiment under Lieut. Bruce Carruthers[6] made a stand against an overwhelming Boer force. They fought until their ammunition was exhausted and 17 of the 21 were either killed or wounded. Private C. N. Evans was mortally hurt, but he fired the contents of his own bandolier and another, and then smashed his rifle over a boulder to keep the enemy from

[3] *Cockburn's pre-war service was with the Governor General's Body Guard (now the Governor General's Horse Guards), Holland's with the 5th (now 4th) Princess Louise Dragoon Guards, and Turner's with the Queen's Own Canadian Hussars, a unit which no longer exists.*

[4] *"D" Battery took to South Africa the guns of the 2nd "Ottawa" Field Battery (now a sub-unit of the 30th Field Regiment R.C.A.).*

[5] *Richardson's pre-war service was with the North-West Mounted Police.*

[6] *Carruthers, a graduate of R.M.C., had served with the 21st Lancers at the Battle of Omdurman, and as an N.C.O. with the 2nd Battalion R.C.R. in the earlier stages of the war in South Africa. He was subsequently appointed to the Permanent Force, was made "A.A.G. for Signalling" and is remembered as the father of the Royal Canadian Corps of Signals.*

(Continued on page 56)

ARMY CONTROL ORGANIZATION

Lt. Col. J. A. Hutchins, MBE,
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Part 2 (Conclusion)

Origins of Our Present Staff System (based upon the British System)

The roots of British Military thought and organization are embedded in the military past of almost all of the Continental European nations. From the days of the amphibious operations of the Romans against the Saxon beaches to the present day, British Military technique has been subject to successive influences and innovations, each reflecting the influence of military leaders of many European nations and lessons learned in battle.

The influence of Gustavus Adolphus of Sweden is evident, especially in the organization of Cromwell's New Model Army which came into existence in 1645 (the beginnings of the regular Army in England). As a matter of interest, I might tell you that the cardinal points in the structure of the New Model Army were that:

(a) It must be an army for general service free from local obligations.

(b) It must be paid not from local funds but from national funds.

(c) The pay must be regular, supplies ample and the dress uniform (wherefore the scarlet coat became the rule in England).

(d) Conscription was necessary to fill the ranks.

Cromwell set a high standard in administrative ability and through the efficient use of staff officers he was able to establish an extremely effective command based upon systematized administration of the Army.

Marlborough's administrative efficiency is recognized by all students as being the basis for nearly all his tactical victories. This administrative efficiency was achieved through the effective use of staff officers. Marlborough's use of his staff left its mark in British Military history.

The Napoleonic era proved to be a stimulus to British Staff thought, culminating with the appearance of Wellington, a leader whose organizational and administrative genius was based upon a profound knowledge of staff theory and technique. Wellington constantly laid emphasis on sound administrative procedure as the found-

ation for tactical success.

Under Wellington, staff organization did not cease with high field headquarters but extended down into divisions where the organization was firmly standardized. The two main divisions under Wellington were the Adjutant-General's and Quartermaster-General's Departments.

Under Wellington staff thought and practice took on a firmer substance than at any previous time in British military history, and as a result, the status of the staff officer as an assistant to the general and as the recipient of delegated powers emerged essentially the same as it is today. In his famous "October Minute" of 1827, Wellington summarized this concept of the status of the staff:

> "Every staff officer must be considered as acting under the direct orders and superintendence of the superior officer for whose assistance he is employed, and who must be considered responsible for his acts. To consider the relative situation of the general and staff in any other light would tend to alter the nature of the service".

A book by Spencer Wilkinson, published in 1880, entitled "The Brain of an Army", a study of the Prussian Military Staff System, (itself the product of the efforts of Generals Gneisenau, Schornhorst, Clausewitz and Moltke), was destined to exert great influence on the course of British Military Staff development. As a result of his study, set out with great clarity and simplicity in this book, Wilkinson's advice was "to infuse into the English system the good features of the German". In the years that followed, this was done.

The Prussians, galled by Napoleonic defeats, correctly appreciated in reorganizing their staff system that the duties of a Commander are so multifarious that some consistent distribution of functions among officers of a large staff is indispensable. In the system designed, (and put to the test successfully in 1866 and 1870), by the generals whom I have already named, this distribution was based on a rational and practical principle. The work was sub-divided into classes according to whether concerned with administration and discipline or with the direction of operations against the enemy. All that belonged to administration and discipline was put on one side of a dividing line, and upon the other side all that directly affected the preparation for or the management of the fighting, i.e., strategy and tactics. The officers entrusted with the personal assistance of the general in this latter group of duties were called his "general staff". Officers so employed were members of the "Great General Staff Corps" and had superior status to that of other staff officers.

At the time when Wilkinson wrote his book (1890), the grouping of staff functions in the British Army was a fact but it was accidental and followed no principle, having arisen by

chance and been stereotyped by usage. The officers of the staff belonged to the Adjutant-General's Branch or to the Quartermaster General's Branch but no rational criterion existed by which to discover whether a particular function fell to one branch or the other.

In 1912, the War Office published a "Staff Manual" crystallizing British staff doctrine, culminating centuries of development. The organization described in this book was to serve as the basis of British Staff organization in World War I, and, with only minor modifications, it has continued to the present time. This system combines the desirable features of the Prussian system with the basic elements of the gradually evolved British Organization. The Adjutant-General's and Quartermaster General's Branches were retained, but a General Staff Branch was added and to it was given somewhat the same responsibilities as fell to the German General Staff, that is to say, responsibility for all that directly affected the preparation for and the management of the fighting, to the exclusion of administration, discipline, supply or quartering. In theory all three Branches of the British Staff have equal status; in practise the Branch of the General Staff, probably because of its German origin where the General Staff was paramount, has, in the past, always enjoyed a subtly superior status, at least in the minds of its members. In the Canadian Army, I feel we have succeeded in eradicating this misconception, and it is fully accepted now that the four branches of the Staff have co-equal status.

I now come to the third and final portion of my remarks in which we take a fairly close look at the staff organization we have in use in the Canadian Army and which we would unquestionably employ in the event of a future war.

Staff Organization for War

Existing Staff Organization and its Functions

Certain officers, who together form the staff, and whose number and ranks are laid down in what we call war establishments, or tables of organization, are appointed to the HQ of the Commander-in-Chief and to those of certain other commanders. The duties of the staff are:

(a) To assist the commander in the execution of his functions of command.

(b) To assist the fighting troops and services in the execution of their tasks.

The duties of the staff involve the performance of the following tasks:

(a) The transmission of the commander's orders and instructions to subordinate commanders.

(b) The collection of information for the assistance of the commander and its dissemination, both to the

fighting troops and services so that action may be taken intelligently on orders transmitted.

(c) The exercise of forethought to ensure that timely anticipation of difficulties likely to be experienced, or of material likely to be required by fighting troops and services in the execution of orders.

(d) The arrangement of all matters with a view to removing anticipated difficulties and facilitating the prosecution of the commander's plan of operations.

The work of the staff is divided and distributed in accordance with the nature of the work to be done—for this purpose four branches of the staff exist:

(a) The General Staff Branch.

(b) The Adjutant-General's Branch.

(c) The Quartermaster-General's Branch.

(d) The Branch of the Master General of the Ordnance.

The duties of the four branches of the staff are broadly the following:

(a) *The General Staff* deals with the employment of fighting troops and with all matters connected with the actual execution of military operations.

(b) The other three branches deal with the maintenance of troops in the theatre of war, including the supply to the combatant troops of everything that is required to enable them to carry out their task:

(i) *The AG Branch* deals with personnel and all the attendant problems,

(ii) *The QMG Branch* deals with movement, (subject to direction by the General Staff Branch), in the actual execution of military operations, accommodation, supplies, engineer and transportation stores, and operation of general mechanical transport vehicles driven by Royal Canadian Army Service Corps personnel.

(iii) *The MGO Branch* deals with research and development, design, provision and maintenance in connection with all Ordnance stores.

A clear-cut division of staff work as described is an absolute necessity at the headquarters of higher formations where the volume of work and the demand for special qualifications are greater than with subordinate formations. Below General Headquarters, the AG's, QMG's, and MGO's branches are amalgamated in degrees varying with each formation.

No perfection of organization of course can make up for absence of care, foresight, knowledge and goodwill throughout the staff. The relationship between officers serving on the staff must therefore be close and cordial. To ensure complete understanding and co-operation, frequent discussions between officers of corresponding grades in all four branches are also necessary.

In accordance with the principle of decentralization of responsibilities

each branch of the staff is organized in a number of sections according to the nature of the duties to be performed, these sections may again be divided into sub-sections.

In this connection, perhaps a more detailed breakdown of the Staff Branch functions and sub-divisions will be of interest:

The General Staff Branch: Its work consists of three main types:

(a) *Plans*—their initiation, subject to the commander's orders, and the drafting and issue of all orders and instructions necessary to put them into execution.

(b) *Information* — obtaining all data required to enable a plan to be formulated and initiated.

(c) *War Organization* — training and liaison.

The General Staff is therefore organized into three main sections:

(a) The operations section.

(b) The intelligence section.

(c) The staff duties and training section.

The AG's Branch is responsible for:

(a) Supply of personnel to forces in the field and arrangements for the selection and despatch to units of all ranks to make good deficiencies.

(b) Care and removal of sick and wounded—reporting of all casualties.

(c) Hygienic and sanitary measures necessary to preserve health and prevent disease.

(d) Discipline—administration of military and martial law.

(e) Burial registration of graves—custody and disposal of effects of the dead.

(f) Disposal of prisoners of war.

(g) Executive arrangements for the raising of new units or modifying existing units.

(h) Welfare and spiritual care of troops.

(i) Drafting and issuing routine orders.

(j) Ceremonial.

(k) Supervision of pay service.

(l) Arrangements for official visits in the field.

The AG's Branch work falls broadly into two main categories:

(a) Matters which affect the personnel of the forces in the field collectively such as organization and medical services.

(b) Those which have a more intimate bearing on the individual, such as discipline, promotion, welfare (bodily and spiritual), pay, leave, individual postings, burial, etc.

The AG Branch is therefore divided into two main sections:

(a) The Organizarion Section,

(b) The personal services section.

At a Corps or Divisional headquarters these two sections are normally combined.

The QMG Branch—the work of this branch falls into two main categories:

(a) Movement.

(b) Maintenance.

The chief duties in respect of these two tasks are:

(a) *Movement:*

(i) Arrangements in connection with embarkation and disembarkation.

(ii) Control of all systems of communication by road, rail or inland waterway.

(b) *Maintenance:*

(i) Supervising and co-ordinating the services responsible for the provision of supplies, engineer, RCASC, (food, petrol and lubricants) transportation stores.

(ii) Priority in order of provision.

(iii) Allocation of accommodation.

(iv) Ensuring the proper scales of reserve supplies and vehicles are held in a theatre but not exceeded.

(v) Labour: enlisted and civilian.

(vi) Arrangements for messing—bathing, fire protection and utilization of by-products.

The MGO Branch in the field is responsible for:

(a) General supervision of the Ordnance Service and the arrangements for the maintenance of ordnance stores, including all mechanical vehicles and spare parts other than those required for RCASC.

(b) Fixing, in conjunction with the General Staff, the reserves of ammunition, explosives and other ordnance stores to be maintained in the theatre.

(c) Research design and development in connection with all ordnance stores and mechanical vehicles and all other types of equipment in consultation with the general staff.

(d) Salvage.

Conclusion

We are forced to change our staff system in detail in numerous ways to meet special contingencies. The over-all pattern has proven remarkably efficient and adaptable, however, under the tests of actual war and provides us with a firm and sound basis upon which to work for the future.

Supplementary Notes and Information

Organization implies that every man's work is defined; that he knows exactly what he must answer for, and that his authority is co-extensive with his responsibility.

The head of a Service is vested with certain technical and financial responsibility, therefore the method adopted in the carrying out of orders should be left for his determination; the relations between the staff and the Services are closely analagous to those between the staff and subordinate commanders. In both cases the staff must be in a position to appreciate what is possible. It is essential that the staff should know the fighting capacity of combatant troops and thoroughly understand the working of the Services.

With the exception of orders on

technical matters, which the head of a service may issue to subordinate formations with the authority of the senior staff officer of the branch concerned, all orders and instructions on administrative matters are issued by the staff in the name of the commander.

The heads of Services are advisers to the staff in regard to matters in connection with their Services. The staff should consult with them before forming an opinion on what can reasonably be undertaken.

During movement, it is essential that a staff officer of each Branch of the Staff should be readily available at some known locality. This is usually effected by dividing the staff at headquarters into two echelons and keeping an office open in one locality with one echelon of the staff until it can be relieved by opening a new office manned by the second echelon of the staff. The first office can then be closed and the staff which was left behind moves to the new headquarters. It is important that all concerned know of the exact times of closing of the old and opening of the new headquarters.

In the case of Corps or Division Headquarters, it will often be convenient for the commander to occupy an "operational" or "tactical" headquarters for the duration of a special operation with a portion of his staff while leaving the remainder at headquarters. An operational or tactical ("tac") HQ is kept as small as possible, the commander being attended there by the senior staff officer of each branch who will leave his representatives to act for the branch at "headquarters".

2nd Echelon (the AG office at base). Its duties are:

(a) Recording the whereabouts of every individual in the theatre and his or her qualifications.

(b) Recording every individual's evacuation from the theatre for whatever reason and reporting it to home authorities.

(c) Recording deaths and location of graves and reporting deaths to home authorities.

(d) Receiving and disposing of the effects of the dead.

(e) Provision of personnel of the required categories and qualifications in accordance with the policy laid down by the senior "A" officer in the theatre, by the submission of demands to home authorities.

(f) Initiating and maintaining statistics regarding strengths, casualties, reinforcements, prisoners of war, sickness and all other factors affecting manpower in the theatre for the information of field commanders and home authorities.

To carry out these duties, 2nd Echelon is organized into five sections:

(a) Records.

(b) Casualty.

(c) Effects.

(d) Reinforcements.

(e) Stats (statistics).

In the execution of his work the officer in charge of the 2nd Echelon communicates directly with officers commanding units of fighting troops and services who supply him with the information he requires.

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The notes which I have prepared and set down in this paper are based upon a study of the following publications: Field Service Regulations, Vol. I; A History of the Staff (Hittle); Life of Wellington (Guedalla); Life of Cromwell (Buchan); The Brain of the Army (Wilkinson); "On War", Vols. I, II, and III (Von Clausewitz); sundry other books, pamphlets and articles on the "staff", including Report of the Department of National Defence for the fiscal year ending 31 March 1949 and white paper entitled Canada's Defence Programme 1949/50 issued under the authority of Hon. Brooke Claxton, Minister of National Defence.

A Wife's Consent Was Necessary

The outbreak of war in 1914 created a situation for which the Canadian military authorities had little precedent upon which to fall back. Enthusiasm there was in plenty, however, and a desire to provide a tangible form of aid to the Empire with the least possible delay. Consequent upon the decision to despatch a division overseas, a considerable number of telegrams were despatched from Ottawa to expedite proceedings. According to Volume One of the *Official History of the Canadian Forces in the Great War 1914-1918*, the following telegram was despatched by the Adjutant-General to Officers Commanding Divisions and Districts on 14 Aug:

"You will please notify all concerned that upon receipt of the orders to proceed to Valcartier, all officers and men who have volunteered and who have passed the medical examination, may be assembled at Valcartier, where a selection will be made and those selected will compose the Division for Overseas Service. No married man will be authorized to proceed to Valcartier without the written consent of his wife."

It was not until 13 Aug. 1915 that a General Order was issued making it no longer necessary for a married volunteer to obtain the written consent of his wife before being acceptable for the Canadian Expeditionary Force.—*J. M. Hitsman, Historical Section, Army Headquarters, Ottawa.*

THE FUTURE OF AIR BOMBARDMENT

AIR MARSHAL SIR ROBERT H. M. S. SAUNDBY IN THE ROYAL AIR FORCE QUARTERLY (GREAT BRITAIN)*

When the Germans realized that the growing weight of Allied strategic bombing would spell defeat for them if they were unable to master it, they determined to convert practically the whole of their aircraft industry to the production of defensive fighters. The German generals, however, knew their business, and they must have felt very uneasy indeed at the prospect of having to abandon the offensive in the air. They could not fail to know that such a policy could only postpone defeat, not avert it.

Fortunately for them, two lines of scientific development offered a possible solution to their problem. One was the flying bomb, the other the heavy rocket. Neither of these weapons required high-performance airplane engines of conventional design, and neither would compete in any serious way with the resources they wished to devote to defensive aircraft. It is small wonder that they seized eagerly upon these inventions, and decided to rely upon them almost completely for the conduct of an air offensive against England.

"V" Weapons

Their plans were well laid and far-reaching. They began to build enormous structures in Belgium and the Pas de Calais, protected by reinforced concrete many yards in thickness, in which they intended to assemble and prepare the "V" weapons, and from which they meant to launch them. They planned for a huge scale of attack: some 500 flying bombs and 200 heavy rockets were to be launched daily against London and other objectives in Southeast England.

Our Intelligence Service got early information of this project. Our heavy bombers, by now capable of a high degree of penetration and accuracy over enemy territory, successfully struck at the great experimental station at Peenemunde, where the development work was being carried out, and at the factories where the weapons were being made. These attacks destroyed the great concrete structures in which the rockets were to be assembled and launched.

The success of this counter-offen-

* *This digest is reprinted from the Military Review (U.S.)—Editor.*

sive caused the enemy to abandon his large-scale plans and rely on small launching sites, and to use natural caves for the storage and assembly of the weapons. This immediately reduced the threat to about one-third of its former dimensions, while a perpetual attack on the launching sites by Bomber Command and the Tactical Air Forces, and the smashing in of the caves by heavy bombers, still further reduced the scale of attack. As a result, the bombing effort averaged no more than about one-tenth of the planned figures, and it declined from being a dangerous threat to a serious nuisance.

Nevertheless, the attack could not be entirely stopped until the advance of the Allied armies had placed the launching sites out of range of England.

The defeat of these "V" weapons should not, however, be misunderstood. They were defeated because they were introduced—incompletely developed, and in insufficient numbers—to a situation dominated, at that time, by the heavy bombers.

Development of Rockets

There is one other significant development of which we must take notice. That is the development of rockets carried in aircraft or other vehicles. So light is rocket equipment that a *Hurricane* fighter was able to carry eight such rockets, with a striking force roughly equal to the broadside of a 10,000-ton 8-inch-gun cruiser.

Thus, we have four quite distinct and very important lines of future development: the flying bomb, the heavy rocket, the light rocket, and the atomic bomb.

Flying Bombs

The flying bomb, as developed by the Germans up to the end of the last War, suffered from two major defects. First, it was too slow; it could be caught and destroyed by our fastest fighters. This defect could be remedied by using a more powerful propulsive agent, to be paid for by increased size and weight of the weapon, or by reduced range. Second, it depended on a pre-set mechanism to cause it to dive to earth and explode on contact, which rendered it inaccurate at long range. In fact, less than 50 per cent could be relied on, even if not interfered with in any way, to fall within a circle of 2½ miles' radius from the desired point of impact, at a range of 120 miles.

No doubt such a mechanism is susceptible of improvement, but it must always be liable to considerable error owing to the difficulty of forecasting wind speeds along the route. The magnitude of the error will, generally speaking, be proportional to the range. In this, it differs in a marked way from the humanly controlled bomber, the accuracy of which in general is dependent on many

factors, of which range is by no means the most important. There seem to be two possible methods of eventually overcoming this defect. The missile can be guided from radar ground stations, much as was "Oboe" bombing in the last war, or the missiles themselves can be made to "home" onto the target.

The first method is likely to be accurate, but, like "oboe", it is limited to a maximum range of some 350 to 400 miles, depending on the altitude of the missile. Only one missile at a time can be handled by a pair of ground stations. Thus, both the range and the density of the attack are sharply restricted. "Homing" presents considerable difficulties, owing to the problem of identifying the target. One factory or one build-up area is very like another, and I doubt whether it will be possible for a long time to produce a device which will enable a flying bomb to select and "home" onto a land target. At sea, however, circumstances seem to me to be very different, and I think that "homing" onto a ship should be comparatively easy. I can imagine a flying bomb being despatched in the known direction of an enemy ship—a great mass of metal floating on the sea—and when arriving within, say, 10 miles of its objective, the "homing" apparatus would come into play. The missile would be guided towards the ship, and an auxiliary rocket motor started, so that the missile would achieve a high enough velocity to ensure penetration.

Such weapons, against which all surface ships would be almost helpless, would make it impossible for warships or merchant ships of any size to approach within, say, 150 miles of enemy territory by day or night.

I think, therefore, that flying bombs are likely to be used for short-range attack of land objectives under "Oboe" or some similar control, or against shipping. Their effect on the exercise of sea power should be very great, and it is probable that all war vessels will have to be made submersible.

Heavy Rockets

The heavy rocket of German "V"-weapon type has a maximum range of about 200 miles. To achieve this, it attains during its trajectory an altitude of some 50 miles above the earth's surface, and a peak velocity of some 4,000 miles an hour. The German rocket had a total weight of about 14 tons, of which 1,500 pounds was the explosive charge, and about 10 tons the weight of the fuel. This fuel, consisting of liquid oxygen and alchohol, had to be pumped through the burners in less than a minute. The accuracy of the weapon was about the same as that of the flying bomb at comparable ranges.

The main characteristics of this

weapon were therefore limited range, indifferent accuracy, approach at supersonic speeds allowing little or no warning, small explosive charge, and a high rate of consumption of expensive fuels.

It is difficult to see how its accuracy can be substantially improved. Nor can its range be much increased without resorting to a two-stage process, vastly increasing its size, weight, and fuel consumption.

It would appear, therefore, that these rockets are suitable only for the attack of large targets, such as an industrial city, lying within 200 miles of the launching site.

Light Rockets

The light rocket appears to me to be a most important development, likely to have very far-reaching consequences. For aircraft, which can use them at short range, I think that they will eventually replace the gun for all purposes. As regards sea and land warfare, I am less certain; but I believe that they will prove to be a lighter, cheaper, and more formidable weapon than the gun for most purposes. They are excellently suited for providing covering fire for an assault, and for laying down concentrations of fire to slow down and break up an attack. They are ideal for close-range anti-tank work, and it is possible that they will largely replace the anti-aircraft gun, especially if a rocket-driven weapon capable of "homing" onto an aircraft can be devised.

The saving, compared to a gun, in manufactirung cost, weight, ease of transportation, economy in high-grade steels, and other metals is most striking.

As an offensive weapon for tactical air forces, the light rocket is, for many purposes, superior to the bomb. For the destruction of locomotives and rolling stock, motor transport, shipping, especially the smaller and more mobile vessels, and aircraft on the ground, the rockets are much more accurate and easier to operate than bombs, and they are fully as effective. In my view, the light rocket has enormously increased the power and effectiveness of tactical air forces.

Atomic Bombs

And now we come to the atomic bomb. This is a weapon of inconsiderable weight but of enormous destructive power. It is probable that one bomb, detonated at the optimum altitude, could devastate an area of about one square mile. In addition, it would affect by flash-burn and by radioactive poisoning all who are exposed to it within a considerable radius from the explosion.

The bomb depends for its explosive effect on a fissionable material, produced from uranium ore. The production of this material, even when the process has been commercialized, requires a tremendous effort in terms of money and manpower, though

probably not much greater than that required to produce its equivalent in destructive effect in conventional bombs charged with a modern high explosive. But this certainly means that atomic bombs will be precious, that no nation will have plenty of them, and that they will be carefully used, after serious consideration, against those targets which are judged to be the most vital and suitable.

The American tests at Bikini Atoll provided much valuable data as to radioactivity and blast effect, and the possibilities of decontamination. But I cannot believe that it is probable that any nation will drop atomic bombs on fleet anchorages. In fact, I will go further and say that in an era of atomic warfare there will not be any fleet anchorages as such. The job of the navy will be almost entirely convoy escort and anti-submarine work, requiring a large number of small ships dispersed all over the seven seas.

Important ports, vital industrial areas, and possible centres of government and communications will be the most probable targets for atomic bombs. The defence of such places, therefore, will be a task of the first importance. To destroy, deflect, or reduce the attack would be the primary object of our active defence. For various reasons, among which is the need for great accuracy, I believe that the atomic bomb is likely to be delivered by aircraft operated by a human crew, equipped with the latest radar navigational and bombing aids.

The potential threat is so great that we must harness all available scientific knowledge and research to the task of improving our air defence. But some attacks are certain to succeed, and we must organize an effective civil defence to minimize the disaster if it should come.

The appalling death toll in the Japanese cities was largely due to the fact that no air raid precautions were in force. At Hiroshima, the streets were thronged with people who supposed that the two American aircraft high overhead were engaged in photographic reconnaissance. No warning was sounded, and no one took cover. It had been calculated that protection such as London possessed by the end of the last war, and 19 minutes' warning, would have reduced the death toll from 70,000 to about 7,000. So it is a very serious mistake to think that, because the destructive power of the bomb is so great, no shelter and no precautions are of avail. The reverse is true. The killing power of the bomb against unprotected people in the open is tremendous, but quite a small degree of protection secures immunity from flash-burn and radioactive poisoning, except for those very close to the point directly beneath the explosion.

Summary

To sum up, I believe that atomic bombs are likely to be used in a carefully worked-out plan, calculated to destroy at the outset the war potential of an enemy, and to bring about the collapse of civil administration. If the attack should fail, the supply of atomic bombs is not likely to be sufficient to permit its being repeated, except after a long interval measured, perhaps, in years.

What all this amounts to is that air bombardment with atom bombs, flying bombs, and rockets is now capable of such far-reaching effects that an aggressor, especially against such a country as England, is almost certain to attempt a knockout blow from the air. London is an obvious target for such an attack, particularly if an aggressor can obtain control of the Low Countries and the Pas de Calais, enabling him to use flying bombs and rockets. Only if such an attack should fail will the safeguarding of our sea communications or overseas bases have any significance. Therefore, although navies and armies are not rendered obsolete by the developments in air bombardment, they will not come seriously into action in their own spheres until the first clash in the air is over. Indeed, land and sea forces will tend to be drawn, directly and indirectly, into the support of the air battle in every way open to them.

Once this battle is decided, the first phase will be over. If the blow has failed, it will then be necessary to plan the second phase, which must culminate in victory. The plan will, of course, depend upon the circumstances, but the offensive in the air must be developed first. It is only when the enemy is beaten and thrown onto the defensive in the air that we can hope to take the offensive by land and sea.

This, then, is the future as I see it. On the Air Force and on its ancillary services will depend the defeat of the enemy's all-out air attacks, aimed at paralyzing us at the outset. On it, also, will depend the development of a successful air offensive, which alone can open the way for the joint air, land, and sea offensive that will lead to victory.

CANADA AND THE SOUTH AFRICAN WAR

Continued from page 42

getting it. The next day six men of the regiment under Corporal W. A. Knisley were cut off and surrounded by a large number of Boers. They dug themselves in and fought a lonely battle for twenty hours, until the corporal and another man were dead and all their cartridges were gone. Such was the spirit of the Canadian soldiers of that day. It's hardly surprising that their countrymen took pride in it.

WHAT IS A STOCKPILE?

FROM THE U.S. MUNITIONS BOARD STOCKPILE REPORT TO THE CONGRESS

In the evolution of stockpile policies, the stockpile itself is considered in four different ways. First of all, the stockpile is a physical reserve of definite quantities of materials, owned by the United States Government, and stores mostly on government-owned property and in government warehouses.

Second, the stockpile is an inventory of raw materials with a cash value; it is a recoverable asset owned by the people of the United States. In this sense it is an insurance policy, the outlay for which would be returned many-fold should the stockpile be used, and yet until it is used it retains value indefinitely.

Third, the stockpile is a basic element and an integral part of the national defence structure. It is not a military element, but is intended for all essential uses—both civilian and military—in time of emergency. It is closely linked to the whole arrangement of provisions for the national security. It relates to military and civilian requirements which are taken into account in the formulation of stockpile objectives. It relates also to industrial mobilization planning, with particular respect to the disposition of the stockpile in time of national emergency.

Fourth, the stockpile provides a tremendous reserve of manpower and time. The stockpile represents manpower and time in two ways. An ample reserve in the stockpile of tin, for example, represents manpower. It takes man-hours of labour to mine the ore, to load it aboard railroad cars and bring it to the water's edge, to load it into the ore boats to bring it to the smelter; it takes more labour to mine the coal needed in the refining process and to bring the coal to the smelter. More man-hours again are needed to transport the tin from the smelter to stockpile depots located near consuming centres of tin. Obviously, if all this is done in advance, time and manpower are stockpiled along with the tin.

But the amount of manpower represented by our reserves in the stockpile is infinitesimal compared with the additional manpower that would be required to carry out essential war-supporting industrial programs without the use of these materials. . . . In the final analysis, materials are stockpiled on the basis not of the manpower required to produce them, but of the *manpower that would be required in wartime if these materials were not available.*

QUESTION TECHNIQUE IN INSTRUCTION

Lt. Col. B. P. Sharma, MBE, in The Infantry Journal (Central India)

Questioning, an essential part of instruction, is a very difficult and delicate art. Recently our attention has been drawn to it by the tour notes of the Commander-in-Chief.

"When to question? What to question? and How to question?" are considerations of paramount importance for every Instructor. There are two types of Instructors—the talkative and the less talkative. The former bores his students with his unending lecture, while the latter leads the class himself, speaking only occasionally. One curbs the zeal of students and the other educates them by his rational and logical teaching. The proper role of a teacher, therefore, is to explain to the students what they cannot understand and at the same time to make them speak out the impressions they have formed outside the classroom and those they have gained during the period. This is the reason why in all regimental schools a lesson must always be given in the form of a conversation between the students and the Instructors.

Questions are used mainly for three definite purposes. First, as tests of knowledge—to test the memory and the understanding power of the students, e.g., the numerous question papers of examinations. Secondly, as a means for developing subject matter. This is an excellent method of presenting a new subject. A string of questions carefully prearranged sets the minds on the desired train of thought and then leads the pupils to discover new facts. Questions having close sequence and intimate relation to the experience of students make them "see" the situation as something real. Thirdly, for developing the personality of the students. This group of questions, in addition to answering the needs of the above two varieties, also aims at developing the students' self-reliance. The Instructor therefore should frame his questions in a manner which will stimulate the students to think independently and set them off in the discovery of new facts.

Questions for testing knowledge must be sufficiently broad in nature and should be couched in clear language. Many examination questions deny scope for initiative. The scrappy character of Instructor's questions leads to scrappy response from the students. Much skill is required while framing questions for the presentation of a new subject

matter. A good series of questions grouped according to superiority, subordination and sequence should be the aim of every Instructor. This is impossible without a thorough knowledge of the subject and methods of the technique of teaching. A still higher degree of skill is required to handle questions for developing the independence of the students. The Instructor must not only be well-acquainted with the subject, but should also have a glimpse of the students' past experience and a definite understanding of their present mental attitude. In the noble task of transferring leadership from himself to his students, a good Instructor frames and handles questions with the same diligent care as would an artist his tools.

Don't let the class know whom you are going to question. Put it to the class in general. If the class knows that a particular student is to answer the question the other students will simply keep quiet without thinking for themselves or they may even be mentally wandering outside the classroom. Questions must be clear, precise and intelligible and must not be too general in scope, e.g., "What have we learnt in the last lesson?" "What did the Constituent Assembly do last month?" . . . and so on. Roundabout questions should not be asked. The best students alone should not be questioned. Everyone must get his chance. If only the chosen few are questioned, others will lose their self-respect or they may even think that the Instructor is unjust. Having put a question, allot sufficient time for clear understanding of the question and for the searching for correct answers. The classroom should be charged with an atmosphere of anticipation.

During one of his recent tours, the C.-in-C. noticed that Instructors in Boys' Units did not set questions in a manner which allowed the whole class to think before the answer was given. The correct method is to ask a question, let the whole class think out the answer and then call upon any student at random to supply the answer. Avoid elliptical questions. Don't ask students to finish half or partial answers, as it gives rise to guessing. Students must be trained to answer any question by themselves. Teach them to speak, always having an eye on those who are silent and shy by nature. Let there be emulation among the students.

Question time engages the students actively. Those who give really good answers will acquire a feeling of progress and achievement. It is said that interrogation is the touchstone to progress. By strengthening memory and consolidating newly-gained knowledge, questioning brings out the latent powers of the students. In this way they are taught how to think, speak and acquire new knowledge.

THE MARKSMAN IS A SCIENTIST

Reprinted from the Canadian Marksman

Others must wonder what there is about that neat hole through the black bullseye of a marksman's target to please him so mightily, or why he suffers such anguish when it appears just a hairsbreadth away from the precise centre. It must often seem to them that riflemen are a queer lot who can't stay away from producing time and time again such completely unnecessary irritations to their unstable emotions.

Actually, there may be some riflemen who wonder at their own antics, but the more thoughtful marksman will say that these insignificant punctures in a piece of paper tell him a great deal about the man who makes them, and that the satisfaction or unhappiness they cause are real measure of his desire for perfection.

First of all, the expert marksman is willing to match himself and his equipment against an ideal just to see the shortcomings in both. This is a virtue not to be despised for most of us fight shy of comparison with perfection and content ourselves with less embarrassing contests. Your true rifleman, on the other hand, deliberately sets for himself a standard just beyond his reach, and when he attains it through conquest of his worst mistakes, sets another still higher, knowing all the time that the process can have no end.

In the second place, your marksman has learned that physical fitness and emotional control are vital to his sport, and has set himself to improve them. He has discovered how little bearing luck has on his score, and how much it depends on stamina, muscular control, steadiness of nerve and mental alertness. His experience has taught him how quickly these powers will tire in competition, and he has trained himself to greater endurance.

The rifleman has also found that his equipment can be improved, and he works constantly with it to eliminate the slightest flaws. He cares for his rifle and other gear with a loving anxiety, and he listens to all suggestions eagerly, sometimes not too critically. He knows that the rifle hasn't been built that will put every bullet through the same hole, but he hopes it will be, and his efforts have brought that objective a bit closer. He's an amateur scientist

with a touch of superstition still.

Finally, your marksman has been compelled to recognize the forces of wind and weather in his quest for bullseyes. He has become sensitive to each puff of wind, each passing cloud, and each raindrop. He's a superb weather prophet — for the next five seconds only — and his anguish at misjudgment is keen. He may not always enjoy nature, but he certainly doesn't ignore her.

Henceforth when you see a target with its tiny perforations in the centre of those black circles, think just a bit about the nature of the marksman who put them there. Those are the symbols of near-perfect co-ordinations between hand and mind; they testify to the greatest care of superior equipment; they indicate experience gained from intelligent practice; and they mark a man who was not afraid to attempt what he intended to be well-nigh impossible. But don't praise his skill too highly, for oddly enough his interest is centered on his poorest shot — the others are what he intended anyway!

The Battle of Oldenburg, 1627

When the cause of its patron, the Elector of the Palatinate, became definitely lost, the Scottish regiment which Sir Donald Mackay had raised in 1626 to fight for Protestanism against the Catholic League transferred its allegiance to the King of Denmark. Despite the fact that Mackay's Regiment and other foreign contingents continued to distinguish themselves in many engagements of The Thirty Years' War, they frequently were on the losing side. What they had to do on one occasion has been aptly described by Cecil C. P. Lawson in his *History of the Uniforms of the British Army:*

> At the battle of Oldenburg, where the forces under the Duke of Saxe Weimar were compelled to surrender to the Imperialists under Tilly, the Reiters (i.e. troopers) in the Danish army having been routed by the enemy's cavalry, galloped from the field to the landing place at Heiligenhaven with the intention of securing the boats there, and so be the first to escape. While they were thus occupied Mackay's regiment arrived on the scene, having fought so vigorous a rearguard action that they were the only force to escape surrender. The Scottish Foot were not the men to stand for any *Deutchland über alles* and the devil take the hindmost, so bringing their pikes to "the charge," they swept the Reiters into the sea, and embarking in the boats secured their retreat.

Subsequently these Scots found themselves on the winning side when fighting in the German Campaigns of the great Swedish soldier king, Gustavus Adolphus. — *J. M. Hitsman, Historical Section, Army Headquarters, Ottawa.*

CHURCHILL ON THE WAR'S THIRD YEAR

A Book Review by Colonel C. P. Stacey, OBE,
Director of the Historical Section,
Army Headquarters, Ottawa

The new volume of Mr. Churchill's memoirs[1] covers the year 1941. That year saw a tremendous expansion of the war, with Russia becoming a belligerent in June and the United States in December. *The Grand Alliance* ends with Churchill winging homeward in January 1942 from the "Arcadia" conference in Washington at which the new Western allies laid the foundations of the organization that they were to use to win the war.

Like its predecessors, the book is fascinating. It illuminates, in some degree, virtually every aspect of the war. It produces a great deal of new information—often in the form of documents that have not seen the light before. (Some of them would perhaps never have seen the light if they had not been published here.) Every army officer and every student of war should study the volume with care. It is quite impossible to do justice to it in a short notice like the present one.

One of the most remarkable features of *The Grand Alliance* is its revelation of the nature of Anglo-Russian relations after the German attack on Russia. A good bit has already been written about this; but from Churchill we get the actual text of the cables he exchanged with Stalin. It was an extraordinary correspondence. The first of Stalin's cables (19 July 1941) demanded not only a Second Front in France but a Third one (in the Arctic) as well; and on 15 September the Marshal really surpassed himself: "It seems to me that Great Britain could without risk land in Archangel twenty-five to thirty divisions, or transport them across Iran to the southern regions of the U.S.S.R. In this way there could be established

[1] The Second World War. *By Winston S. Churchill.* [*Vol. III*] The Grand Alliance (1950). *Published in Canada by Thomas Allen Limited.* $6.00.

military collaboration between the Soviet and British troops on the territory of the U.S.S.R." Clearly the Russians knew nothing about the problems of moving troops across great bodies of water; clearly, too, they had the same inflated notions as the Germans concerning the number of divisions in the United Kingdom. Churchill's comment is not exaggerated: "It is almost incredible that the head of the Russian Government with all the advice of their military experts could have committed himself to such absurdities".

One of Stalin's later communications was so rude that Churchill did not attempt to answer it; and after a time the Soviet Ambassador called to say that it had not been intended to give offence. All told, relations with the Kremlin were not the grandest part of the Grand Alliance.

Of the tremendous responsibilities which fell upon Churchill one of the heaviest was that of choosing—and removing—commanders. This volume deals at length with the relations between himself (and the Chiefs of Staff) and General Wavell, Commander-in-Chief in the Middle East. The circumstances preceding Lord Wavell's removal in June 1941 (which followed a series of reverses) are fully dealt with. He was replaced by General Auchinleck (with whom the Prime Minister almost at once began to have difficulties which are also described). But we are not always told about such things. It is noticeable that not a word is said directly about the reasons which produced the replacement of Sir John Dill by Sir Alan Brooke as Chief of the Imperial General Staff. One can, however, read between the lines; and one notes the surprise and disapproval with which Mr. Churchill greeted a paper written by Dill in May 1941 which strongly emphasized the continuing danger of German invasion of Britain and put the security of Singapore above that of Egypt. It is clear that the two men's strategic conceptions were very different, and there seems little doubt that this was the basic cause for Dill's departure.

Very occasionally one can catch the great man in a small error. Sometimes this is the case in connection with his accounts of the doings of the enemy, concerning which information steadily continues to accumulate. For instance, he tells us that the Germans' 7th Flieger Division, which attacked Crete, was "destroyed" in that battle. "The whole structure of this organisation was irretrievably broken. It never appeared again in any effective form." The Division must indeed have been in very bad shape after Crete; but in the summer of 1942 it was in Normandy, and was one of the reserve divisions alerted at the time of the Dieppe Raid. In 1943 it was redesignated the *1st Parachute Division.*

Whether it was "effective" in this new form, let Ortona, Cassino and San Fortunato tell.

One point in Mr. Churchill's account of the defence of Hong Kong is worthy of mention. He follows General Maltby in stating that the Japanese "employed a force of three divisions" against the fortress. We are now quite certain that this is inaccurate. There was only one Japanese division—the 38th Infantry Division—at Hong Kong; though it was strongly reinforced with extra artillery, etc., and had under command an extra infantry regiment which acted as a covering force in case of any Chinese attempt to relieve the colony. It is perhaps as well, in present circumstances, that the facts of the Hong Kong fighting of 1941 should be fully understood. Incidentally, Mr. Churchill reveals that in January of that year he had refused to reinforce Hong Kong ("It is most unwise to increase the loss we shall suffer there"). Later he "allowed himself to be drawn from this position", and the Royal Rifles of Canada and the Winnipeg Grenadiers were sent. This was one of those cases where second thoughts are *not* best.

* * *

There are not a great many direct comments on Canadian matters in this volume. The only fighting Canadian soldiers did during 1941 was that at Hong Kong. The bloodless Spitsbergen expedition is briefly and not entirely accurately mentioned. But there is much material of interest from the point of view of the position of the Dominions in the war. Most of it concerns Australia.

Mr. Churchill relates that the Australian Prime Minister, Mr. Menzies, was "not . . . satisfied either with the organisation of the [British] Cabinet or with my exercise of such wide powers in the conduct of the war". He wanted some sort of permanent Imperial War Cabinet containing representatives of the Dominions. Neither Churchill nor the Prime Ministers of the other Dominions agreed. "Mr. Mackenzie King in particular deployed formidable constitutional arguments against Canada's being committed by her representative to the decisions of a council in London." Mr. Churchill and Mr. King both disliked the idea, but, it would seem, for different reasons. Churchill opposed it because, while he was always glad to welcome a visiting Dominion Prime Minister to the War Cabinet, permanent Dominion representation would enlarge this body to the point of rendering it unwieldy. Mr. King, on the other hand, was evidently primarily concerned with the protection of Canadian autonomy against the encroachment of any central authority in London.

The author deals at length with a

serious controversy with Australia in the autumn of 1941. The Australians asked for the relief of their division holding the isolated fortress of Tobruk. "They desired to collect their troops in the Middle East into one force in order to give them an opportunity for refreshment, restoration of discipline and re-equipment, and to satisfy public opinion in Australia". This involved interference with General Auchinleck's plans for a new offensive in the Desert, and serious embarrassment to the Navy. Churchill argued eloquently and at length with the successive Australian governments of this period; Auchinleck even threatened to resign; but the Australians were adamant. So the relief proceeded, and on 26 October Churchill telegraphed grimly to Mr. Curtin, "Our new fast minelayer, *Latona*, was sunk and the destroyer *Hero* damaged by air attack last night in going to fetch the last twelve hundred Australians remaining in Tobruk." The United States was not yet in the war, and "this unhappy episode", as the author calls it, demonstrates the extent to which the United Kingdom was prepared to cater to a Dominion's wishes on a point which the Dominion's government thought important. One wonders what the reaction of an American Supreme Commander would have been to such a proposition as Australia's on Tobruk; and one suspects that the proposition would have been turned down.

One point which will impress everyone who reads this and certain other parts of the book is British sensitiveness to what Churchill calls "the hostile propaganda which asserted that it was the British policy to fight with any other troops but our own and thus avoid the shedding of United Kingdom blood". He was very anxious to bring new *British* infantry divisions from England into action in the Middle East. Here we have a very probable explanation of the British Government's marked willingness to have the Canadian divisions remain indefinitely in the United Kingdom. The last thing it wanted was to move more Dominion troops to Egypt at a time when it was already being accused of deliberately fighting its war there with such forces.

This volume, so interesting in itself, whets the reader's appetite for what is yet to come. The next one should give us much enlightenment on the very important strategic discussions of 1942.

TWENTY MILLION WORLD WAR VETERANS

A Book Review by Lt. Col. H. M. Jackson, MBE, ED,
Director of the War Service Records Division (DVA), Ottawa

Twenty Million World War Veterans. *By Robert England, Oxford University Press, Toronto, 1950. Pp. 222 ($3.00).*

With one-third of the voting strength coming from the war veterans, who affect one-quarter of the population of the United States and Canada, it is not to be wondered at that the destiny of this powerful section of the community and its effect upon the welfare of these nations should represent a question of importance and significance. Politically, this constituency has already made its influence a power in both countries. In their economies, there have been and will be repercussions for generations. Socially, the value of the efforts and the monies spent upon gratuities or bonuses, treatment services, education and welfare is beyond calculation. Ethically, the very fact that such immense efforts should be made in acknowledgment of the debt of society to these men and women, is a movement which is bound to affect all such future services to the public as a whole.

The author has succeeded in showing the significance to the entire fabric of life of the hosts of veterans in North America, because of their numbers, of their organizations and of the treatment accorded them by governments. Besides describing what has been done for them and also by them, he suggests various courses open both to governments and to the veterans themselves for the future in an attempt to bring all the efforts expended towards their welfare into line with a social policy constructive and progressive, and at the same time induce the veteran to accept his own obligations to society as a whole.

Mr. England discusses the history of veterans' movements in the United States and Canada from the early days on this continent, and of public assistance to its ex-soldiers. To Canadian readers, his story of American efforts will undoubtedly be of interest, and towards this side of his work little comment is offered.

Qualified by his knowledge and experience to undertake a work of this nature, the author brought to

bear years of activity as Western Manager of the Department of Colonization and Agriculture of the Canadian National Railways in organizing community progress competitions and citizenship-training projects among the Central European immigrants in the Peace River District and Central British Columbia upon similar problems in the War of 1939–45. To the projects of education and rehabilitation for the personnel in the Services, he applied his knowledge of the problems of group-assimilation and adult education, and prepared the plan for educational services; was the first director of the Canadian Legion Educational Services and served on a number of federal committees planning re-establishment measures. This volume was written to discuss the entire topic of the rehabilitation of the veteran during his tenure of a Guggenheim Fellowship, 1945–47.

In discussing the work of the Canadian Pension Commission and the War Veterans' Allowance Board for veterans' welfare (pp. 84–6), it is considered that the author does so somewhat cursorily, while his criticisms are not always tenable. When he asserts that "it looks as if the two bodies were doing two different kinds of job", and that ". . . as far as the unemployable theatre of war veteran is concerned, the dichotomy is certain to result in anomalies", and suggests "rationalization of administration in line with this fact" (the inability of the veteran to earn or secure an adequate income whether owing to physical or economic causes), he overlooks the fact that these bodies were set up for different purposes and to deal with different problems.

The pension is compensation for loss suffered by death or disability, whereas the allowance is not. The pension is awarded for a handicap in the general labour market or for death, incurred during service, whereas the war veterans' allowance, frequently referred to as the "burnt-out pension", is intended to provide for the veteran who served in an actual theatre of war and as a result is prematurely aged at age 60. It has paralleled the old age pension, and a different type of veteran from the disability pensioner under the Canadian Pension Commission is the recipient.

The writer continues by proposing "the revision of the elaborate structure of twenty-one classes of disability with uneven steps in the amount of corresponding pension award and the percentile rating of disability . . . ". "What arithmetic of human handicap", he asks, "could possibly estimate a one per cent difference on the margin of total disability?" In assessing the degree of disability, the measure used is to assess the

veteran's employability in the unskilled labour market, according to the Chairman of the Commission.* If because of wound, injury or disease, for which the Commission concedes entitlement, the veteran is unable to follow any unskilled type of employment, he has a disability. The table of disabilities used by the Commission records a series of estimates for definite disability conditions, and serves as a guide for medical advisers and examiners. It was formulated on the advice of a committee of specialists and provincial compensation officers. The point which apparently has escaped the author of this volume is that the Commission never have assessed a disability to one per cent, but do so in multiples of five. When, for example, a veteran has a disability of 40 per cent, with a pre-enlistment condition aggravated by service, the latter factor is conceded, and as a result the Commission considers the length and type of service and his condition when discharged, and assess him for the aggravation of disability at 3/5ths of 40 or 24 per cent.

As to the charge that the classes of disability are inconsistent, it must be conceded that a measure of compensation is necessary. The author also contends that it can hardly be denied that the identifiable severity of the handicaps covered in 93 to 100 per cent ratings should command full pension and might be termed simply "very severe" without adding up physical defects like marks in a school examination. Perhaps he did not consider the number of cases in which a veteran has several disabilities, the sum of which may reach 93 or 95 per cent, while there is a number who have as high as 120 per cent, (loss of an eye, 40 per cent, plus amputation of a leg, 80 per cent, for example). The latter can only be graded 100 per cent, of course.

The study of compensation is a vocation in itself, and in fact with the Canadian Pension Commission, one which undergoes contant revision. When the author asserts that "there is strong presumption that the percentage ratings of thirty years ago and today can have very little consistency", he appears to be unaware of this practice and also that the Commission do keep abreast of the constant improvements in the practice of medicine.

A further word about allowances as differentiated from pensions may be useful. A paraplegic case receives the maximum helplessness allowance of $1,400 a year in addition to a total disability pension, and a blinded veteran a 100 per cent pension plus an allowance of $960 a year. The minimum helplessness allowance is

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* *Brig. J. L. Melville, CBE, MC, ED.*

$480 a year, so if a veteran has only a five per cent pension, is totally disabled and helpless and also in need of attendance, he may be paid what helplessness allowance it is considered he needs within those limits ($480 to $1,400 a year).

Two additional points of great significance to the disabled veteran might well have been stressed in a work of this nature. The first was a departure from previous practice with these ex-service personnel of the War of 1939–45. When medically boarded for discharge, if the board form received by the Commission recorded a disability, it constituted an application for pension and action was taken immediately to prepare it for adjudication. The second is the right of a pensioner to a review of his pension on submitting additional supporting evidence or making a claim for a new condition.

After discussing the work of the Canadian Pension Commission on behalf of the veteran, the author goes on to speak of the Canadian Civil Service Act and the veterans' preference (p. 87). ". . . the problem of determining priority between veterans of two wars under the Act still remains insoluble, revision having been avoided", he declares. The Civil Service Commission has never made any attempt to differentiate between the preference to veterans of the two wars, but on the contrary has carefully refrained from making any distinction. The only discrimination evident arises not from the Civil Service Act but from the Superannuation Act, in that the veteran of the Great War of 1914–18 who desires to count his service in that war must pay interest from the period of the war on the amount he pays as a contribution for his term of service, whereas the veteran of the War of 1939–45 pays only from the date of his service.

The author then asserts that there must be evidence under the Act not only of incapacity in the pre-war (not the pre-enlistment) occupation, but that a new occupation had been tried unsuccessfully in the post-war period. The criteria of the Commission in this matter are whether the disability is of such a nature as to prevent the veteran from carrying on efficiently his pre-war occupation, and that he has not been re-established since his discharge. The question of re-establishment is one for sound judgment, and in this respect the Civil Service Commission tries to fit the individual to the job he is best capable of performing.

It is not a fact that the Civil Service Act makes no provision for the preference to merchant seamen, for if a seaman served in a merchant ship flying the white ensign, he is entitled to be treated as a veteran. Merchant seaman, moreover, were

independent, and signed for one voyage only at premium rates of pay which compare more than favourably with those of men in the Services, who in addition signed for a lengthier voyage.

There are, however, two anomalies in the Civil Service Act not mentioned by the writer, one being the fact that the widow of a veteran who died as the result of service gets the veterans' preference, but the age limits were not waived for her as for the veteran; and the second that the widow of a veteran having overseas service receives the preference, but not the widow of the ex-serviceman who died or was killed as the result of service in Canada.

The author discusses the "unsolved problem" of the 40,000 Canadians "who have certain rights by statute as veterans, but are denied full title by the terms of the War Service Grants Act . . . those called up under the National Resources Mobilization Act, 1940, who refused to volunteer for overseas service and served in Canada only" (p. 100). Originally, the total number of N.R.M.A. soldiers enrolled was 158,000, of whom some 58,000 took the obligation for general service, leaving approximately 100,000 in the class of which the writer speaks. He puts a number of questions about their treatment, asserting that "something went wrong with the military conditioning of these Canadian draftees". "Was it that Officers and N.C.O's. who could not themselves qualify for overseas combatant duty were obliged by the syllabus to rely overmuch on old-fashioned squad-drill and training procedures?" he asks. Many of the Officers and N.C.O's. had had overseas combatant service, while drill and training procedures were similar to those of other formations of the Army. "Was it undue segregation from the civilian population?" There was no undue segregation from the civilian population, for N.R.M.A. soldiers had the normal periods of leave and because of their service in Canada, every opportunity of going home denied to their overseas comrades. "Or the unwillingness of staff to undertake the conditioning of minds to responsible citizenship . . . ?" Methods of education were the same as for all other parts of the Army. "Did we try to make soldiers by a prescription more suited to reformatories or jails — disagreeable fatigues and duties, uniform with a stigma, hard labour without purpose . . . ?" No attempt was made to render the lot of the N.R.M.A. soldier disagreeable, and there were no differences in uniform, save that the general service soldier wore a very small worsted badge bearing the letters "G.S."

The greatest difficulty was not

on the part of the N.R.M.A. soldier himself, but rather one for his superiors, who had to treat him differently from other soldiers and account for him separately in almost all respects, so that he represented an additional and harrassing administrative problem.

There was so much public controversy over volunteers and N.R.M.A. soldiers the matter became a positive hindrance to the training of these troops. May the matter not be looked upon in the light of one these allowable differences of opinion encouraged in a democracy: that in a total of nearly 1,100,000 Canadian service personnel, only about 100,000 did so other than voluntarily or refused to "go G.S.", about one in eleven?

When the author speaks of the demobilization problems of the United States in 1918-19 (pp. 20–21) and says that Gen. Frank J. Hines "traded food for German ships, pressed Italian, French and Spanish liners into transport service, and increased the capacity to 343,000 veterans a month westwards — more than had ever been carried over the Atlantic eastward when British ships were available," he is accurate but hardly fair, as it should not be forgotten that during the war days when carrying American troops, British shipping had very many other commitments and moreover the Atlantic was then under the menace of enemy submarines. To transport the number of troops actually carried in the light of these factors was a modern miracle.

It can not be agreed that " . . . the Duke of Wellington would have found warfare in the South African War much like what he knew in 1815," (p. 32) since the great lesson learned by the British Army in South Africa was that war was totally unlike any other previously waged, a lesson resulting in the great little regular army which fought Mons, Le Cateau, the Fighting Retreat, the Marne and the Aisne in 1914. Still less can it be admitted that "the private soldier until 1914 was bullied like a serf, and fed, housed, clothed, and paid badly. . . . 'Taking the shilling' . . . meant acceptance of an inferior social status, the surrender of amenities, educational opportunities and civilian freedom, . . . " This picture of the life of the man in the ranks of (presumably) British Forces surely refers to an earlier day, for the British Armies had undergone a number of major reforms in the preceding century, at the hands of such men as Cardwell, with the result that the soldier of 1914 was competent, intelligent and moderately well cared for, clothed and fed. His pay was small, but he had his entire living provided and could look forward to a pension, and in addition the dis-

parity between it and the pay of the civilian was probably no greater proportionately than between the two today, taking account of the changed economic factors involved.

Similarly the author's description of certain alleged evils of army life are open to question and may possibly appear not as evil as their counterpart in civilian life, in which, it is related, workmen doing a good job in a war plant were told to "go slow" in their own interests. We like to think that in civil life a man is paid by results and not by status as in the army, says the author, but in the army the individual's status is achieved because of the results he has produced by his skill and efficiency, and such additions to pay of rank as "trades pay" may be lost for inefficiency and so may rank, even "confirmed" rank, under certain conditions.

In discussing employment, the writer gave no emphasis to the men who entered the C.A.S.F. in 1939-40 from the ranks of the unemployed, who had never had an opportunity to work in their lives; yet they were setting out to defend their country. They formed a higher proportion of the formations then raised than is perhaps realized, and their numbers have probably had some effect upon the re-establishment problem.

Commendation is due the author's tribute to the work of prosthetics, the science and art of restoring the form and function of a faculty lost through war service, and less important, to his use of the terms "First" or "Second Great War," although in his title and elsewhere he does speak of World Wars. Britain at least has been one of the chief participants in at least five world wars, so that the terms "World War I" and "World War II" are inaccurate for the Empire. Although the official Canadian Government designation is "World War II" for the War of 1939-45, it is still "The Great War of 1914-18" for that conflict.

In his chapter on "Demobilization (1945-1946)," it is stated (p. 67) that "it became necessary to abandon the points system and start over again with repatriation by units" in repatriation from overseas. The writer of this review had a good deal to do overseas with the system of allocating "points" for priority in repatriation and does not recall the discontinuance of the principle in favour of any other. At the same time, every effort was made to send back units intact where applicable.

The number of war brides of ex-servicemen is much higher than 15,000 (p. 82) and stood at least three times as high as that figure. From 60,000 to 70,000 wives and children were brought to Canada, all told.

(Continued on next page)

48th HIGHLANDERS SEEK AN A & T STAFF

Anxious to secure the services of a Regiment Drill Instructor who would be available for additional work in the Orderly Room, Quartermaster's Store Orderly Room, Quartermaster's Stores, and on the Rifle Range, the Officer Commanding 48th Highlanders asked in January 1904 if such an instructor might be secured from the Gordon Highlanders, the regiment with which the 48th had recently become allied. Requirements were that he be "in all respects a competent Battalion Instructor, a good penman, and, what is essential in a Militia Regiment, a man of good habits, tact and judgement." Pay and allowances, inclusive of Imperial pay, would be equal to £150 yearly, which might be supplemented "by giving private instructions in fencing or other gymnastic exercises." The engagement would be for three years, with the option of extending it to five years and the privilege of returning to his Corps.

One year later the request was repeated, with the added inducement of £40 for transportation. Two sergeants expressed willingness to accept, but the War Office insisted that the arrangements be made by the Canadian Government rather than by the Regiment. This necessitated a formal resolution being passed by the officers of the 48th Highlanders, who reduced the travel allowance to £30.

Under these terms the Gordons furnished the 48th Highlanders with an A & T Staff of one NCO, who sailed from Ireland to begin his duties on 1 January, 1906.

In October 1907 he tendered his resignation, stating that his assistant was quite capable of carrying on. He gave as reasons his desire to return to his Regiment, for he did not wish to spend another winter in Canada.—*Contributed by the Historical Section from Dept. of National Defence files.*

TWENTY MILLION WORLD WAR VETERANS

(Continued from preceding page)

The author is at his best in discussing training and education and rehabilitation, in which fields he has had long and valuable experience. He has succeeded in compiling a volume which serves to show not only the immensity of the veterans' movement, the scope and power of Government assistance, but also the imponderables still to be faced.

GOLD MEDAL PRIZE ESSAY

1948-49

Lt. Col. C. W. T. Kyngdon, Branch of the Master-General of the Ordnance, Australian Army Headquarters*

"No armed service can have a high degree of morale unless, amongst other things, it is nourished by the goodwill of the community from which it is drawn. Discuss this statement, indicating the the positive steps which can be taken by the Australian Army to ensure that it has the support of the Australian people as a whole."

Part 1

Ogilvie and Annandale's dictionary defines "Morale" as the "Mental condition of soldiers as regards courage, zeal, hope, confidence and the like." Using such a definition it could be argued that high morale should be attainable in soldiers without the goodwill of the community, and doubtless in the days of small forces of mercenaries this sometimes was the case. To meet modern conditions of war, however, national armies contain a large number of citizen soldiers, whilst conditions of a modern society make it impossible for the regular components of such armies to live in detachment from the main stream of the national life.

A wartime article in a journal dealing with psychology discussed "morale" at length and listed a number of "ingredient factors, or components of morale." Of these the following, rephrased in places to suit Australian peacetime circumstances, indicate very clearly that morale must be susceptible to the attitude of the community towards the soldier:—

Self-respecting status in employment.

A purpose in life.

A zeal for the job to be done.

Feeling that one's job is useful.

Recognition of work done towards establishing the nation's security.

Feeling of solidarity with all Australians.

Freedom for constructive criticism.

Confidence in leaders.[1] [Footnotes appear at the end of this Article.—Editor.]

Unless the attitude of the community reinforces these components of morale the soldier will come to feel unwanted and restricted, and will therefore be discouraged.

The goodwill of a community towards its soldiers must be more than a mere feeling of friendliness; it must be, as the dictionary puts it, "entire willingness", prompting active co-operation and help. As the

Reprinted from the Australian Army Journal.

Australian people, like all societies of men, is made up of groups each with certain recognisably distinct characteristics, the steps by the Army to secure this goodwill and co-operation may often have to be directed towards a particular group, rather than towards the whole community without distinction of its parts. Consequently, before positive steps to secure goodwill can be proposed, a study must be made of the past and present relationships of the soldier and the various component groups of the community.

History of the Relationship of the Community with the Soldier

The earlier position of the soldier in the Australian scene could not fail to establish feelings of suspicion and resentment. Men pass on their experiences and attitudes to their children often without any conscious effort, and this must have been particularly the case before the coming of universal and compulsory education. Thus the ex-convict could scarcely be expected to instil in his sons a love of his own recent gaolers; the free citizens of New South Wales, as a result of the "Rum Rebellion," must have been most antagonistic to the New South Wales Corps; and the memories of the "Eureka Stockade" still touch deep currents of resentment against the use of armed forces in aid of the civil power. Immigrants, too, in many cases would bring with them similar attitudes derived from analogous experiences in their former lands. It is not surprising, therefore, to find in the records of our country fairly frequent mention of suspicion of standing forces and a resentment of compulsion in military service. This can be seen in the accounts of the conscription campaigns of the First World War, and again in the acclaim in some quarters when compulsory training was suspended in 1929. Typical of this body of opinion are the words of (then) Senator Pearce on August 4th, 1901, when he was criticizing a "Bill for Establishing Universal Military Service in Australia." He said:

"In this Bill we are faced with one of the greatest dangers that have ever confronted the people of Australia. . . . Born as we are in the atmosphere of liberty and free government, we will not become part of a force which strikes deeply at the root of free government as this Bill does . . . The Bill had its origin in the mind of Military Commandants, but the string they played upon to dupe a credulous public was our White Australia Policy."[2]

Even though those holding such views at one time may later have expressed very different ones, such an attitude has consistently appeared throughout our history.

Another prominent Australian, Dr. Maloney, exhibited another familiar point of view when, on the subject

of the formation of an Australian National Defence League, he said:—

"I am absolutely in accord with an Australian Defence League, free from the frivolities of the gilt-spurred roosters who seem to consider a well-fitting uniform of more importance than the art of shooting straight."[3]

In marked contrast to these attitudes towards formal military organization and conventions in peace is the feeling amongst almost all sections of the community towards Australia's participation in wars, and the public acclaim of the soldier and of military virtues on those occasions.

Stanley Brogden, in his book, *The Sudan Contingent*, speaks of the spontaneous public enthusiasm of the day:—

"In the country districts there was great excitement. At Bathurst on the Tuesday night a meeting formed a branch of the Permanent Artillery. The following evening the entire population turned out to farewell the Bathurst Contingent for the Sudan. At 10.30 p.m. a crowd of 14,000 gathered at the Railway Station to see the 13 volunteers, fully armed and resplendent in their scarlet tunics, blue trousers, and white helmets, leave for Sydney. The City Band read its music by the light of torches. There was some fun in being a soldier in those days."[4]

Although at that time the Sydney *Bulletin* was antagonistic and derisive, the majority of the Press supported the formation and despatch of the Contingent, and it is apparent that in 1888 an upsurge of public feeling resulted in a considerable enlargement of the defence forces.

This favourable attitude continued, despite some setbacks when soldiers were used in aid of the civil power during strikes until, in the *Official History of Australia in the War, 1914–18*, we read:

"A survey of organs of opinion and of the political speeches delivered during the (election) campaign makes it clear that Australia at the beginning of August, 1914, was substantially unanimous in her determination to share the perils and burdens of war with the rest of the Empire. She made her offer of service freely, and there was no group which did not approve."[5]

In 1939 the unanimity of 1914 was not repeated quite so definitely, certain members of Parliament and others at the time opposing our participation. These, however, appeared to undergo a genuine change of heart when the Japanese attacked, so that the country from then to the end of the war exhibited complete unity of purpose in prosecuting the war.

Nevertheless, in war, too, the strong underlying dislike of military rule and of compulsion in military service quickly manifested itself upon any suggestion of these coming into

being, as the following extract concerning censorship, from the *Official History of Australia in the War, 1914–18*, shows:

"The appearance of armed squads, under the command of officers, at the business premises of firms trading under names of German origin, with instructions to search for documents, conjured up visions of military rule totally out of harmony with Australian traditions. Protests were voiced in Parliament."[6]

History, too, shows that the Australian citizen soldiers adopted a rather similar attitude to soldiering, there being among them a substantial body of opinion against compulsory service and the more formal and traditional army practices and conventions.

Another very important historical feature is the official distrust of the Army officer, particularly of the "Military Commandants", or Headquarters Staff, as evidenced in the example already quoted. Members of Parliament, civil servants, and men in public positions have often been quick to resent any attempt by an army officer to voice an opinion on a matter of public interest, even though it may be genuinely relevant to defence.

It is apparent therefore, that, historically, the sentiment of the Australian community towards the Army is liable to considerable variations in accordance with the imminence or otherwise of war, and that there is an element which is consistently opposed to what is commonly called "Militarism."

Attitude of the Community to the Army Today

This necessarily brief historical review, however, is only of value as a background to the study of present day attitudes which are the ones that we must promote, influence or combat if we are to secure the goodwill of the community towards the Army in the future. The first difficulty, as mentioned earlier, is that a community is not necessarily a "whole", particularly in sentiment or opinion, and we are thus faced with the need to understand the attitudes of the various groups in the community. Such an analysis must largely be a personal one, for, apart from two public opinion pools on compulsory training and another on the "Digger" hat published in the Melbourne *Herald* and its associates, I have no knowledge of any planned attempts to assess the attitudes of the Australian public to defence matters and the Army.

For the purposes of this study, I suggest a grouping of the Australian community as follows:

- Wage earners
- Property owners and businessmen
- Professional men.

Across these classes cut the other four great divisions of sex, age, rural

or urban domicile, and returned servicemen or otherwise.

Many Australian wage earners appear to be suspicious of military conventions, distrustful of officers, and quick to resent any form of compulsion in military service. Some, too, seem to find difficulty in accepting an organization in which a trades union has no place. Then amongst officials of wage earners' organizations one cannot ignore those who profess or lean to political creeds which advocate disruption or extreme social and political change, because these men can, by reason of their position, greatly influence the opinion of others who might normally be favourable to the Army.

Since women largely tend to conform to the opinions of their men folk on public questions, and since amongst wage earners women workers are also subject to the direct influence of union officials in a manner which has no counterpart in the associations of other groups, the attitude of women wage earners is likely to conform closely to that of their men folk.

As regards the wage earner who is a returned serviceman, it is likely that the insistent and traditional need for wage earners to stick together in their efforts to improve their conditions will tend to make the wage earning ex-serviceman adhere to the general view of his union on major questions concerning the Army.

A sense of economic security gives greater play to independent thought, and this, combined with the greater mental training required in highly skilled trades and clerical work, may result in the more highly paid tradesmen and clerical workers deviating from the general consensus of opinion among wage earners, so that one may reasonably expect more support from them for the Army.

It would thus appear that action to secure the goodwill of wage earners should be directed towards the removal of distrust and suspicion, the building up of a sense of comradeship between wage earners and the soldier, and to combating the false views on the Army put about by disruptionists.

Property owners and businessmen, for many reasons, may be expected to have a less inhibited attitude to the Army than has the wage earner. Such people generally have the advantage of a wider and higher education which enables them to appreciate better the need for defence forces. The Armed Forces have not in recent times been used against these social groups nor is there any reasonable ground to fear such use in future. These groups, too, are more accustomed to formality in social and business life and are favorable to discipline and convention. They have provided a great number of officers as well as other ranks in peace and war, so that they have a

better knowledge of the make-up of the Army, and of its procedures and customs. At the same time property owners are traditionally jealous of their possessions and impatient of taxation, whilst businessmen are highly critical of inefficiency, red tape and waste. It is among this group that one hears so often the view that a man of ability is wasting his talents in the Army, that the military mind is rigid and academic, or that Army methods are wasteful.

The professional man is, I think, more favourable on the whole to the Army than the other groups. He has most likely studied civics, history, and the art of leadership, and in so doing acquired a wide vision and an appreciation of the problems of military science and organization. His group has supplied a relatively high proportion of military leaders in war, who, not having been accustomed to civilian administrative methods, have often been able to grasp more readily the principles of military administration.

Women among these last two groups will have many divergent attitudes towards war, but their attitudes toward the soldier will be conditioned considerably by the bearing and behaviour of the soldier himself.

To secure the goodwill of the property-owning business and professional groups, action needs to be directed to explaining the reasons underlying proposals, providing evidence of efficient and economical administration, demonstrating that the forces are well disciplined and to fostering contact and interchange of ideas with the Army leaders.

As regards the remaining cross divisions of society, it may be said that country dwellers as a whole appear to be more aware of the realities of defence than urban dwellers, and to seek military service more readily, whilst the young are more apt to be swayed by radical creeds and nostrums than are older people. Measures to secure the goodwill of each of the vocational-economic groups need to be "trimmed" to the cross currents of these last two divisions.

Attitude of the Army to the Community

Equally important to our purpose as an understanding of the historical and current attitudes of the civilian to the Army is an appreciation of the soldier's attitude to his community. Efforts to secure the goodwill of the community will be of little avail if the soldier himself either fails to co-operate with or actively antagonizes his fellow citizens.

As with civilians, it is useful to divide soldiers into certain broad groups of which those most appropriate for our purpose are:

- The Regular Officer.

- The Regular soldier with long service.
- The Regular soldier with short service.
- The Citizen Force officer.
- The Citizen Force soldier with long service.
- The Citizen Force soldier with short service.

The Regular officer, on the whole, has chosen his profession for other than mercenary reasons. He takes his responsibilities towards the country seriously, but views the working of civilian life with a certain degree of detachment. His frequent transfers from state to state in peace time give his a wider Australian outlook, whilst his training overseas give him an understanding of the realities of the British Commonwealth. Contrary to the belief of some people, he is not, I think, authoritarian in his outlook. He generally has definite personal standards of dress and conduct, and is impatient of the slovenliness and lack of manners so regrettably common in civil life. On the other hand, some regular officers tend to become fixed in their thinking and others to stagnate. Much of an officer's training is in theory and there is a danger that it will make him doctrinaire. It is easy for him to feel cut off from the main current of civil life and so become reluctant to publicize the fact that he is a soldier and diffident about striving for regular army standards in the forces as a whole.

The long-service regular soldier has some of the characteristics of the regular officer in his attitude to the civilian community but, possibly because of his constant renewal of contact with the civilian mind in dealing with recruits, he does not tend to detachment in the same degree. On the other hand he may have developed a love of order and system which would tend to make him favour authority and discipline in society. Of the three groups in the regular army he is probably the one most readily liked and accepted by the community as a whole.

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(To be continued)

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