for example may be of nearly the right size, but they do not look real enough to the film camera's critical eye. They also have to construct all the tables, chairs, control panels, radio sets, and glasses to one-third scale.

Unfortunately, not every movement or part can be fulfilled by a puppet and real hands and feet occasionally have to stand in for the puppets. This raises anoother problem—clothing; this has to be scaled up exactly from the puppet as in the final film both puppet and actor will be the same size, so every button, badge and crease has to be exactly right.

With several sets being worked at once, filming proceeds at a rapid rate, even though each 30-minute episode takes approximately 150 hours to produce, and costs an astronomical amount of money! A new series is well under way, and this promises to be just as exciting as Captain Scarlet. Finally, we would like to thank *Century 21* for their co-operation which enabled us to produce this feature.

INTRODUCTION TO BATTLE

By Charles Grant

THE BRAKES shrieked madly in protest as the three-tonner roared round the bend and slewed to a halt in a cloud of choking dust. From its rear men spewed out onto the road and flung themselves into the shallow ditches on either side. There they lay, clutching their weapons and waiting . . . about them the air was still, and even the sky was empty, the customary drone of aircraft for the moment absent. They were conscious only of the muted boom of a far-off barrage —more felt through the ground than actually heard. The captain slowly raised his head and peered along the road, hardly daring to breathe as he tried to pierce the haze with shaded eyes—could that be a ruined house by the roadside in the middle distance? What did it hide? Was it empty or did the enemy lurk behind its shattered walls? The answer was almost immediate—a blaze of fire from the ruins, a fiendish howl overhead and a shattering explosion from the road behind. A cloud of dust blanketed everything and the men coughed and choked, but it was true then—there *was* a Mark IV in the ruins—as the recce had suggested—and it had to be destroyed. The captain looked over his section—ten riflemen and a bazooka team—and mentally measured the distance along the road. As his mind raced to solve the problem of approach a second shell burst in blinding red and yellow fire in the field to his right. There was little time to waste, what was to be done?

What would you do ?

Yes, indeed, what was to be done, and what would *you* have done in the commander's place? How would *you* have coped?

If you think you could have done so, it is the easiest thing in the world to find out—in miniature, that is—with the aid of a few model soldiers and some miniature fighting vehicles, guided by a little knowledge of how fast your little men can get about in relation to, say, the speed of a tank; how far a bazooka shell will travel and, if it hits its target, how effective it will be. All these factors and many more which seem quite obvious, together with others not so apparent, can be worked out and assessed in the form of rules for a game which, for want of a better title, we might call "BATTLE." This game has been played for many years in all sorts of conditions and, in an attempt to reproduce the strategy and tactics of any period you like to name—Ancient Greek, Roman, mediaeval, and Napoleonic—metal or plastic soldiers have marched and countermarched on a multitude of tabletop battlefields (or, let's face it, it could be the floor, which gives a heap more room!). All over the world all sorts of people, of every shape and size, young and old alike, have tried to prove that they could have done a great deal better than Alexander the Great, Caesar, The Black Prince, Wellington or Montgomery—to name but a few.

The beginning

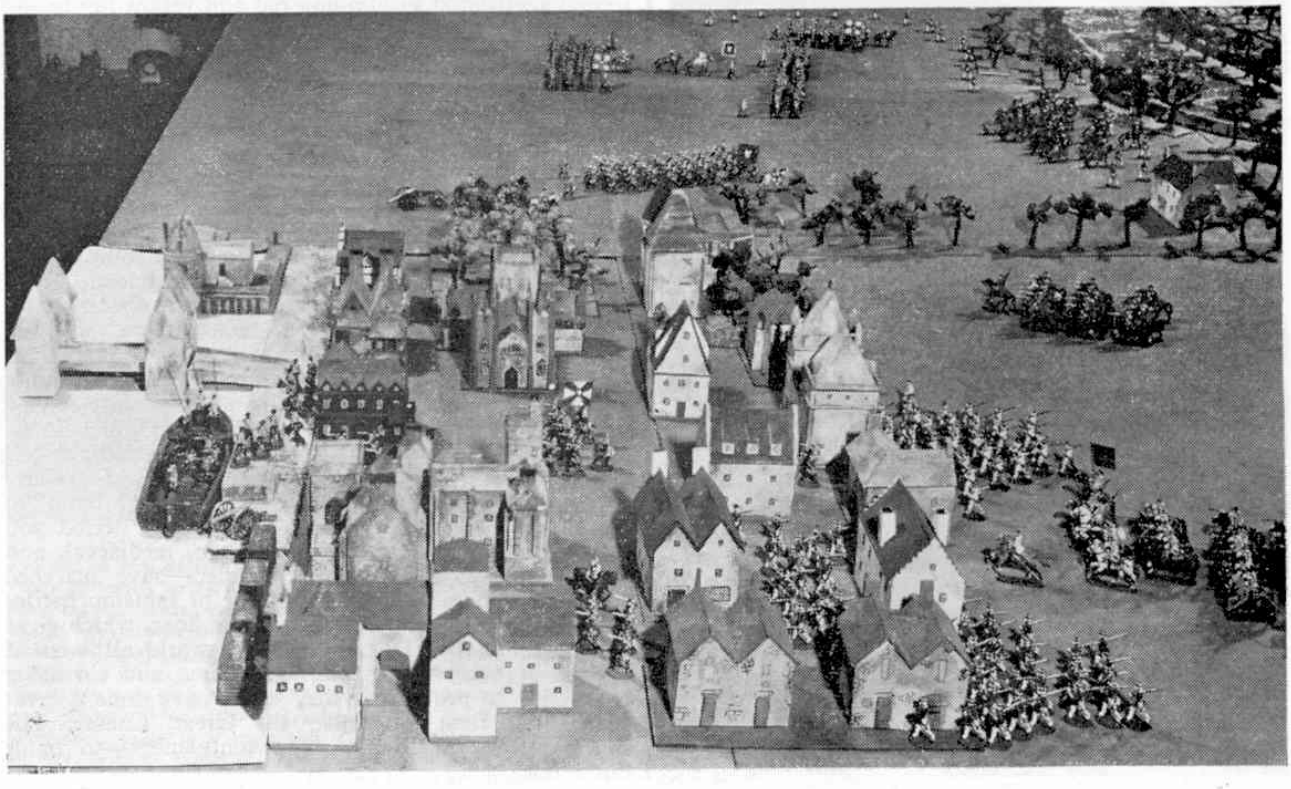
We must walk before we can run, however, and in the beginning at least we are not going to be quite so ambitious as to try to emulate these illustrious characters. After all, few great commanders started out by controlling large armies—even Napoleon began his military career as a humble lieutenant of artillery and Montgomery had to do his two years, or whatever it was, at the Royal Military College, Sandhurst. The idea is then to start off in a much more modest way (we hope that promotion will be fairly rapid, though, and that ere long we shall be directing the movements of forces rather greater than those with which we initially take the field) and first of all to assemble a body of troops to find out what they can do. Here will come a judicious mixture of a little research and practical experience—trial and error, if you like—and with a set of battle rules at our elbow we can "have a go" at some sort of enemy who will doubtless spring up from somewhere to threaten us with fire and sword—in a manner of speaking, that is.

Planning the game

First of all, it might be as well to devote a word or two to what we are planning and it might be a good thing to be clear about this. Briefly, the Battlegame—and quite definitely the operative word is "game"—is simply an extension of many other games which have come down through history, the sort of game I mean being those like chess and draughts, where two players set out to defeat each other by skill and guile, not unmixed in many cases with a little luck here and there. Both these games I mention are in a way—if I might be so bold—elementary forms of Battlegame. You have your powerful pieces—bishops, rooks and so on—which might represent heavy weapons such as tanks and artillery, and the lowly pawn taking the place of the infantryman. In draughts you have the ordinary pieces and the "kings" having the same sort of relationship. Our game—at least I hope it is going to be "our" game—is one based on the movement rates and capabilities of different types of soldiers and their weapons in a particular period of military history. The player is going to direct and manoeuvre these men as he would in an attempt to carry out some military task. We—the battlegamers—have a great advantage in that we can draw up our own set of rules for our game—and no two players will ever completely see eye to eye in this matter, as they—the rules—depend very considerably on the inclinations and set-up of the individual player, chiefly whether he has loads of time at his disposal and has a private battle area—i.e. a table—or whether at some crucial moment of the game the rattle of teacups and saucers coupled with fragrant odours from the kitchen indicate that—for the general good (no pun really intended)—troops and equipment should be rapidly whipped off the dining table and returned to their quarters (boxes or shelves) until battle can be resumed at some future date. (This can be more than frustrating to a commander just about to carry out some complicated and devastating manoeuvre calculated to end in the utter discomfiture of his opponent!)

What we are going to do then is to draw up a set of rules for our battlegame, assemble an army—a small one to begin with—and set about devising some kind of battlegame wherein two or more players can simulate the excitement, the stress and the strain of directing a battle in miniature.

The primary consideration is to determine in which period we are to set our game. Now this hobby—and it has a tremendous number of enthusiasts—has the great virtue that one can set one's game in any of a dozen historical epochs and still have enormous fun and excitement. All sorts of different eras have their ardent supporters—everyone has his particular favourite—but I think that, for a variety of reasons, we shall stick to fairly modern times. By this I mean something round about the end of World War II, say, 1944-45.



At the foot of opposite page we have a typical village layout as used in a Table Top Battle with troops positioned as they would be in a real battle. The buildings, etc., are not fixed as they would be on a railway layout, nor is there a great deal of scenic work, as different Battles have different layouts.

Charles Grant and his son study a wall map in the picture above. With the help of historical reports and area maps, many Battles that helped to shape our modern history can be reconstructed and refought in the light of new knowledge and the way you would have directed the Battle.

This is primarily because weapons and vehicles of those years are so well known and documented that it is an easy undertaking to draw up scales of speed, armament, range of guns and so on. So there we are, about to create rules for a 1944-45 battlegame and with one exception are ready to get cracking.

Soldiers; type and scale

The exception is that we are as yet without the necessary troops and we have to decide on what type of miniature soldiers we shall employ. Here we have a pretty wide choice—of size, material and cost—and it's up to the individual battlegamer to make his own decision here. It would be reasonable, however, to give one or two pointers to guide his choice, and if he doesn't agree, fair enough, that's his privilege. The first question is one of size. Broadly speaking there are three—first, what is called " standard " size—that of the ordinary toy soldier—this being, for a man on foot, 54 mm. (we are obviously not going to have to bother with " horsed " cavalry). This—roughly $2\frac{1}{2}$ in. in height—is generally speaking considered to be rather too large for our purpose, particularly as we have to get vehicles, tanks, guns and so on in a similar scale, and even without such things, a group of soldiers of this size would take up far too much room on the battle area we hope to use. An intermediate size is 30 mm. —the infantryman then being about $1\frac{1}{4}$ in. tall—and finally there is the 20 mm. scale, the man on foot being about $\frac{3}{4}$ in. in height. Now, these scales, particularly the last, are regrettably by no means constant, different manufacturers having pretty elastic ideas about what constitutes, say, a 20 mm. figure, and you might find that figures from two different makes vary appreciably in height and bulk. Not to worry, though, after all, men do come in different sizes.

Personally I have no tremendous brief for either the 20 mm. or the 30 mm. figures (or for the 54 mm. for that matter) but for many reasons—the principal one being that if one is to have even a small number of vehicles involved in the game, then a field gun or tank in anything bigger than the 20 mm. scale is going to be far too large to fit in with what we hope to achieve and will go far towards creating all sorts of anomalies and complications which could well foul things up generally.

Let us suppose then that we have chosen to operate in the 20 mm. scale. The troops therefore will probably be plastic—they are easily and inexpensively obtained, although metal soldiers in this scale are also available. The latter usually cost a little more and are more prone to accidental destruction (after all, you can drop a plastic figure onto the floor with impunity, but do the same with a metal figure and it will be retrieved almost certainly minus a head, a stand or some other vital part of its miniature anatomy.

A great weapon; the British 25-pounder, along with the German 88 millimeter one of the two most renowned guns of World War II. Here it has just come into battery position and with its tractor still in attendance is waiting for action.

BATTLE

by Charles Grant

PART TWO

A Beginning with the Rules

ALL—OR nearly all—the board or table games I can think of involve the opposing players moving their pieces alternately. This system can also apply to the "Battlegame," but it has its disadvantages, notably that the player moving first immediately gives away some idea of what his plans might be to the "enemy." Of course, when the second player has *his* move, then *his* opponent can see what the counterstroke is likely to be. In the long run, it may well average out, but even in the fairly elementary sort of thing we are immediately concerned with, it is better that the players move their pieces—i.e., their troops—simultaneously. This can run up against snags in the more complicated type of game to which we hope to graduate, but by then we shall have some experience in these matters and it will be found that such problems can be solved with a minimum of effort. That same experience shows, too, that the simultaneous move does produce considerably more excitement in the players and speed in the operation of the game.

We'd better make it clear, by the way, what we mean by a "move" which can also be called a "bound" or a "turn" (I've heard both terms used by players with great experience in the hobby). It simply means this. In draughts, for example, a player moves one piece from one square to another—this constituting his entire "move." In "Battle," however, the player can move all his pieces, units or what have you the maximum permissible distance for the particular type of piece involved. If he wishes, naturally, he can obviously leave parts of his forces stationary. This general movement—based on rules we shall shortly go into—makes up the bulk of what we shall call, for want of a better term, the "game move"—the remainder being concerned with the firing of whatever weapons the player can bring to bear on his opponent's forces, men or machine. Quite simply then, the "game move" consists of both players simultaneously moving and/or firing all the troops and weapons they wish to do within the limits of the rules for movement and firing shortly to be described.

The first thing we have to do is to establish the various moves for each particular piece—be it man, gun or vehicle. To do this we shall have to decide on something to act as a kind of yardstick on which the overall scale of different movements can be based. The simplest way of doing this is to start with the object which has the slowest rate of progress. This without doubt is going to be the soldier on foot, plodding along under full kit, carrying rifle, sub-machine gun, or something equally ponderous like a bazooka or part of a heavy machine gun. Here may I interject a point which is of great importance in drawing up the rules? Just as a man, burdened even as we describe, can make a terrific effort and run like mad over a short distance, so a tank, with the driver "putting his foot down" can, particularly on a road, belt along for a spell at a rate greatly in excess of its normal economical cruising speed. Therefore, right at the start we must make it

clear that we are not going to complicate our lives by allocating a number of different speeds to each type of unit in our " army." In the beginning it is necessary to dispense with a number of interesting refinements, but we want to get on with an actual " Battle," although a simple one, as quickly as possible. Afterwards, all things being equal, we can carry on with something a trifle more sophisticated. To this end, the moves we are going to set out at this stage are going to be an " average," a sort of " mean." So here goes.

First of all, as I said, we are going to begin with the infantryman and at the risk of repetition I'll say again that this is going to be an average of his rate of movement and at the moment it does not really matter whether he carries rifle or machine gun, or whether he is marching along a road or making his way through a muddy, ploughed field—there is an average of these various speeds and this will do as our basis for what we are going to calculate—the distance he covers in our " game move." This will, in fact, be the key to all our other moves and indeed to the range of the weapons we introduce into our game.

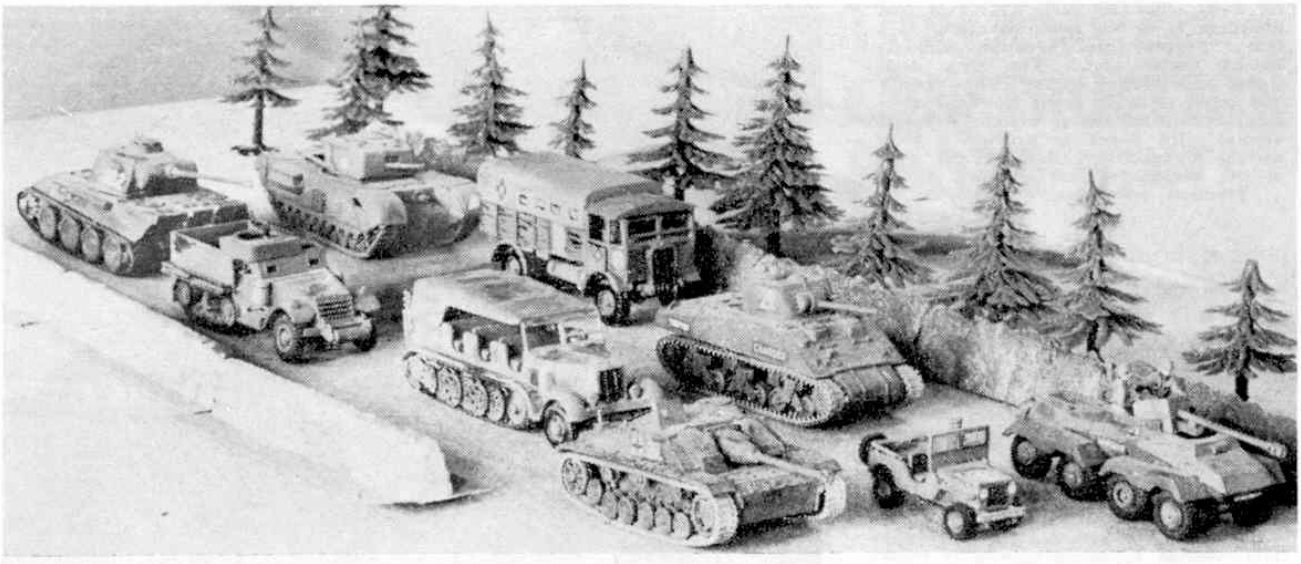
At standard marching speed of 120 paces to the minute, and reckoning the pace as being 30 in., an infantryman will cover 100 yards in this time, equivalent, in round figures, to a speed of 3 m.p.h. This then is the basis for our scale of movement. Again, as I have said, when it comes to the " crunch," the man can move much more rapidly over a short distance—a quick burst if he is suddenly under fire and making a dash for cover. By the same token, there will be times when he will wish—or be obliged—to get about more slowly, so if we take the 100 yards/minute speed it will suffice as an average. It is the " mean " we have already decided to adopt.

With this as a starter, we can now see—I hope—just where we are going. To a considerable extent this will depend upon the amount of space we have at our disposal—generally speaking, how big a table we have, in effect—and the immediate problem is to translate the 100 yards/one minute relationship we have just established to a convenient equivalent we can use in the " Battlegame." If one is fortunate in having a large table (I'm lucky in that mine measures nine feet by seven), then the infantry move can be quite substantial, but if one is not in such a happy position, then it will have to be pretty small. This is not an insuperable difficulty, however; it will be found that long marches on foot are not frequent and it is envisaged that there will be plenty of transport to bring our footsoldiers into action, and only after they have " debussed " close to the scene of operations will they be obliged to have recourse to " Shanks's Pony."

The " move " of either man—or vehicle—will consist of the distance over which he—or it—travels in a specific interval of time, be it seconds or minutes or even hours in certain circumstances. The longer the time interval, patently the greater will be the distance involved in the move, and this is what we must watch, else troops and vehicles will rapidly vanish over the edge of the table we are using for our " Battle." It is hoped that the moves suggested will suit the majority of players, but I would point out that it is perfectly simple—if the player desires—to increase or decrease them, either by multiplying or dividing them by the same number. If I suggest then that the infantry move be 3 in., the player might prefer to have it rather longer and might double it. This is fair enough, as long as he doubles all other moves—the relationship between them must be constant. It must not be forgotten that if he does increase the basic infantry move, then some others—I can think, for instance, of a fast scout car driving along a road—will be, in proportion, quite enormous. Also, as we shall see, weapon range is also governed by the same scale, and if we don't want to set up artillery in another room, or out in the garden, it—the scale—must of necessity be a rather modest one.

So to conclude—taking one minute as being a convenient time interval to represent the " game move," and remembering that the infantryman was taken to move 100 yards in that time (or 3 m.p.h.), let us enact that the infantry move be of 3 in. This represents 3 m.p.h., so a move of 1 in. being therefore equivalent to 1 m.p.h. this will be an admirable frame into which we can fit—in our next instalment—" Battle " moves for all sorts of vehicles, whether armoured or " soft-skinned."

Advance ! A strong column of tanks, with infantry in close support, noses forward towards the enemy. On the wooded knoll behind can be seen a blockhouse now to be abandoned as the troops move on.



BATTLE

by Charles Grant

Part III—Rules for movement

Above, pass in review: a selection of some of the types we shall be meeting in "Battle". They include three of the tanks mentioned in the text—Panther, Churchill and Sherman, as well as two varieties of half-track vehicles and a German armoured car. On opposite page, defending a river crossing, a tank is in position just over the bridge and two anti-tank guns are also located to cover any attempt of the enemy to force a passage.

NOW THAT we have established a kind of yardstick for our movement rules in the shape of the statement that, in one game move, an infantryman may cover a distance of 3 in. on the battlegame table, this being the equivalent of 3 m.p.h. (on the basis that 1 in. equals 1 m.p.h.), it will be an easy matter to determine the speeds—and consequently the moves—of any sort of tracked or wheeled vehicle we consider that we shall find useful in "Battle".

What we shall do is to take a selection of most of the better known types in use towards the end of World War II, German and Russian as well as those of Britain and the U.S.A. If possibly it appears that I give undue emphasis to the 'foreigner' it is simply because I feel that it is better if two opponents in the game choose to have, for example, German and Russian forces respectively, rather than that one should suffer pain when one's national pride is offended on seeing maybe a Churchill tank 'brewed up' by a Tiger. It might be a good idea (and one that I use myself, as do many other players) to have quite fictional armies. I know one player whose country rejoices in the name of 'Myopia'. It also allows complete freedom of choice in the equipment one can 'import' and there is then no reason why, if the player wishes, he should not have German armoured cars and American tanks in the same organisation. It's all part of the fun of the game.

At the beginning at least, though, I shall not have much to say about what you might call the 'super' jobs—the 'Josef Stalin', the King Tiger and so on. It is simply because experience shows that a much better game results from the use of the less enormous varieties of tanks etc. and this indeed will be my guide through this exposition of our game of "Battle". By the same token, it is also better to work on a system of averages—as regards speed, defensive value and fire power.

We shall see this first in our estimation of speeds to calculate the table moves of our vehicles, although in this it is inevitable that we shall have to have a dual scale, but of this more in a moment. Obviously, everything that moves can go dead slow or flat out, but in between there is what can be called an economical cruising speed, which may be maintained for the greatest distance with the minimum expenditure of fuel. Couple this with the fact that, on the battlefield, men and vehicles do not go tearing about at a great rate; among other things it makes firing very difficult, whether it be the rifle of the infantryman or the gun of the tank. It also cuts down the chance of an observer's being able to pick up anything in the way of a target from a rapidly moving platform. There is the additional point that, except possibly in the pretty specialised field of desert operations, speed of tank movement was frequently limited to that of infantry, one in support of the other with a consequent reduction in speed. So we are going to be required to establish two speeds, one which is a sort of battle speed where, shall we say, an advance is being made against a vigilant foe, care being taken to 'flush out' any hiding place where evilly disposed enemy troops may be lurking, and with guns trained ready to fire at any suddenly appearing target. This will generally take place across country, where hedges, muddy fields and all sorts of obstacles will in any case tend to reduce the rate of progress. Opposed to this is the ordinary road speed where the question is simply one of getting from 'A' to 'B' as rapidly as compatible with general conditions and fuel consumption.

It should be pointed out that it is a general experience that the maximum speeds given in specifications for all manner of vehicles—and this applies to aircraft as well—are usually pretty optimistic, and the figure given, if it can be reached at all can be done for only the minimum of time and with the worst possible effect on the engine involved. Thus we shall attempt a compromise, one which will give a road speed something like the economical cruising speed we mentioned already. As time goes on, the enthusiastic battle-

gamer may well wish to operate rules which allow for such bursts of speed; he may find it necessary to move very rapidly to restore a desperate situation, say, this being similar to the 'forced march' for which rules can be made by players operating in 'horse and musket' periods of military history. In these early days, however, I feel it better to adhere to a fairly basic set of rules, the earlier to get on with having an actual battle.

Let us then proceed to note a series of movement rules—across country and on roads—for the ten or a dozen vehicles we are going to employ in "Battle". May I preface this by saying that I am well aware that many tanks and the like had numerous 'Marks', as improvements and modifications took effect and that each had its own characteristics, but let me reiterate my plea about an 'average'. In any case, as far as estimation of speed is concerned, any difference would be rather negligible in the scale we are using.

First of all, then, we shall take the Panther—the German Pzkw V—thought by many, and with some justification, to be one of the best all-round tanks of World War II. It was more or less inspired by the Russian T.34 which, in their campaign in Russia, the Germans found to be more than a match for the Mark III and Mark IV tanks they had found adequate in their campaigns in Poland and France. Its maximum speed is quoted as being about 30 m.p.h. This is of course a road speed and for our purposes—to obtain the cruising speed—we shall reduce this by half, arriving at a rate of 15 m.p.h., or, translated to our battlegame scale for the table (where 1 m.p.h. equals a move of 1 in.), a road move of 15 in. Similarly, we shall not go far wrong if, for the cross-country move, we again cut this by fifty per cent, giving us a move of 8 in. (the nearest round figure—we don't want to clutter things up with half inches). All this bearing in mind, naturally, that the infantry move is one of 3 in.

The T.34—the Russian job—comes in two varieties when it relates to the question of armament, but this will be discussed later. They are identical as far as speed is concerned, and this is in fact the same as that of the Panther—i.e. a 15 in. road move and an 8 in. overland one. If we take a third tank, the American Sherman, we find that it didn't really measure up to the previous two—although, as World War II progressed, it became of increased importance, if only through sheer weight of numbers. Maximum speed of the Sherman was 24 m.p.h.—by our rules then its moves are 12 in. and 6 in., road and cross country respectively.

VEHICLE	MOVE	
	ON ROADS	ACROSS COUNTRY
Panther	15"	8"
T.34	15"	8"
Sherman	12"	6"
Churchill	7"	4"
Half-track	15"	9"
Truck, jeep, armoured car	24"	6"
Sturmgeschutz	12"	6"

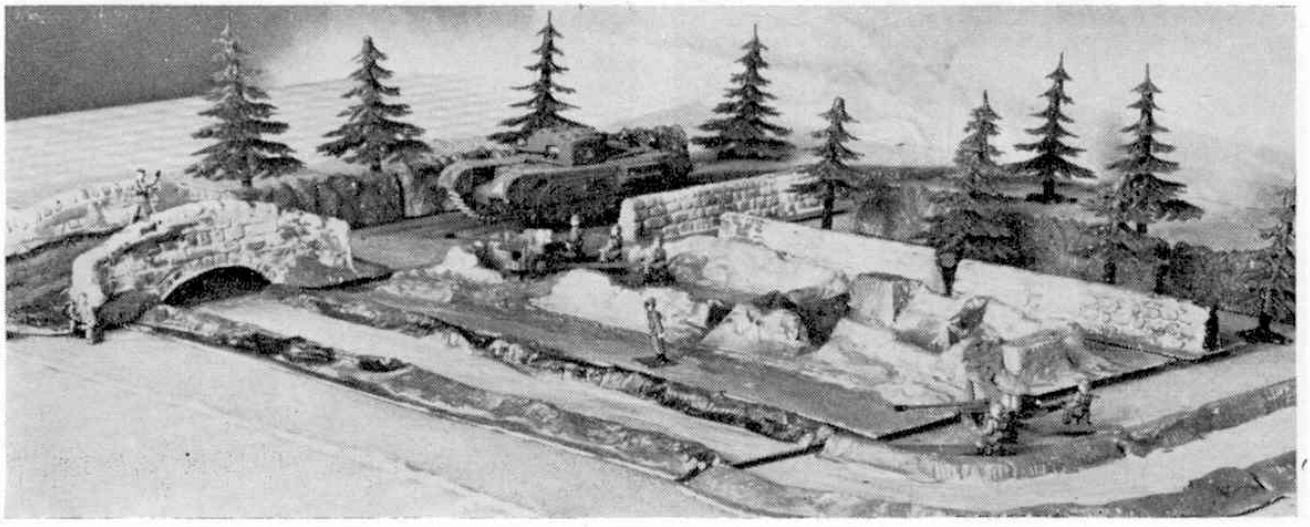
(May I again remind the reader that these figures are quickly arrived at approximations for the purpose of establishing an elementary set of rules in the shortest possible time).

It would really be incorrect not to include a consideration of a British tank which must, of course, be the Churchill. It was primarily an infantry tank, stoutly armoured, manoeuvrable but slow. Its performance gives it moves of 7 in. and 4 in.—not very fast even in comparison with the Sherman.

Half-tracked vehicles were in general use by nearly all the Powers and they had a multitude of uses. Taking the German SdKG7 as an example, we find that it had a maximum speed of 30 m.p.h.—a 15 in. road move—and a cross country speed of 18 m.p.h.—or a 9 in. move overland.

Wheeled vehicles, such as scout cars, naturally had the advantage over their tracked counterparts on roads, but found it hard going across country. On the former they will therefore have correspondingly greater moves, let us say 24 in. on roads but 6 in. only overland. For the time being we shall lump together all these types—trucks, jeeps, armoured cars—into the same speed category, reserving any refinements until later.

One last type we might mention is the selfpropelled gun. The German version of this, the Sturmgeschutz, is well known. Like other types it was simply a field gun or howitzer mounted on a tank chassis, and used in close support of infantry, its road speed being 12 in. and its overland move 6 in. (It didn't have to be terribly fast, for obvious reasons).



BATTLE

by Charles Grant

Part IV—

The Infantryman's Weapons

SOMEONE ONCE described the infantry arm of the ground forces as the " Queen of Battles " and even in this day of guided missiles, super tanks and what have you, the description is still pretty apt. In any case, as we are starting from basics it is only fair that our next consideration should be for the infantry soldier and his weapons. As we shall do for tank guns and conventional artillery we shall first, before we attempt to calculate their striking power, assemble some rules for their range, beginning with the smallest and working up to the most powerful.

Within these terms of reference the first is obviously the revolver or automatic pistol. This is, generally speaking, an officer's weapon but can also be used by tank crews and similar personnel. It wasn't a great deal of use, sad to say, a fact which might be considered surprising, conditioned as we have been through the years, first by the cinema and then by the television. If we are to accept what is pumped out by these media, our idea of what a man can achieve with a pistol or revolver is going to be grotesquely in error. It would appear to be commonplace, for instance, for a cowboy to pick off men on galloping horses at ranges of what appear to be several hundred yards. This, needless to say, is just plain bunkum. A first rate pistol shot, operating under competition conditions in an enclosed range, will take ages to get a single shot off at a target not much more than a score of yards away, and this with a favourite pistol, equipped possibly with partial wrist support. There is not much chance for a man to do this in action, when snapshooting is the invariable rule. At any range above about twenty yards we can therefore say that, by reason of the inaccuracy of the weapon and the fallibility of the operator, both pistol and revolver are completely ineffective. However, let us not be ungenerous and, recalling that our scale is 100 yards = 3 in. (this was the basic infantry move, you will remember), give the hand-held weapon a range of 1 in., or approximately 33 yards (in the real thing). When it comes down to brass tacks the pistol is practically a mêlée or close-combat weapon.

Working up the scale we come next to the sub-machine gun. Not tremendously used since the advent of the self-loading rifle, it was in general service in the period we are interested in—World War II—particularly by the Russians. It seems that a very high proportion of their troops was so equipped, whole units being issued with sub-machine guns instead of with rifles, giving tremendous firepower at short range. If we wish to equip an army on Russian lines, then a large number of tommy-gunners will have to be included, and they would certainly come in most useful in street or house-to-house fighting (the Stalingrad type of operation, for example). It—the tommy-gun—did have a number of advantages; it was easy to handle and its size enabled it to be carried by crewmen in the confined space of a tank.

Now for its range, which was not enormous, as the normal ammunition had a low propellant content, and which was considerably less than that of the rifle. The S.M.G.'s employed by the various contending powers had accurate ranges of up to 200 yards or so, but this seems to be an over-estimate, I feel, and if we allocate a maximum range of about 140 yards to our S.M.G. we shan't be very far out. This, converted to our table scale, is 4 in., or as near as makes no difference. (Here may I interject that when we get round to assessing the effect of the sub-machine gun, or any other weapon for that matter, the range at which it is firing will have an obvious effect on its accuracy and consequently upon its effectiveness. The rules will provide for this in due course.)

With the tommy-gun taken care of, we go on to the classic weapon of the infantryman, to wit, the rifle. We shall not try to differentiate between the various national types—this would complicate the business intolerably—but we'll try to take an average sort of weapon and give it average sort of capabilities. O.K. ?

Right, then. Frequently, one thinks of the rifle as having a most prodigious range (these TV. characters again!) and we read of infantry opening fire at a thousand yards range and so on. However, it is a fact that a World War II infantryman's chances of hitting a man-sized target at that range with a rifle are quite literally not tremendously greater that those of an eighteenth century soldier's doing the same with a " Brown Bess." (A point of interest—I am told that the thousand yards target at Bisley is ten feet across by six feet high and that the " bull " is sixty inches across! And this is for the best shots in the country, so how could a normal average infantryman hope to emulate this ?) A former instructor at the Army School of Infantry assured me that—leaving out the specialist " marksman," the chap who in earlier days would have been termed a " sniper " —he, the instructor, would have been quite pleased to see the ordinary infantryman hit a man-sized target at 200 yards! A bit of a comedown from what might have been our pre-conceived ideas on the subject. In point of fact, the present-day rifle is sighted up to 300 yards for general action, and this I feel is a much more realistic range for our riflemen—so we accordingly lay down the rule that maximum rifle range is 300 yards or, on the table, 9 in.

Now we come to a very powerful weapon indeed, the machine gun. This comes in a variety of shapes and sizes, including the British Vickers .303, the Russian D.Sh.K. 12.7 mm. (frequently mounted on a splendid little two-wheeled trailer with a shield attached which could be trundled around by the crew) and the American .5 Browning. All had well defined qualities of reliability and punch, but their functions were similar—to lay down patterns of fire and to inhibit the movements of enemy infantry, and their effective range (as opposed to maximum range) was similar, depending as it did upon the eyes of the crew, aided or unaided. Before going on it might be as well if we described what we are considering—the heavy machine gun—particularly as the calibres of those mentioned vary considerably—between .3 in. and .5 in. in fact. It—the heavy machine gun—can be defined as a " tripod mounted defensive machine gun," and by this token the actual calibre does not matter. Now, the Vickers is described as having an accurate range up to 600 yards, and I think that this will suffice for our purpose. The tactics and technique of machine gun fire can be pretty complicated, but what we shall initially do is to employ it in its

simplest role—for direct fire—and for that purpose we shall take the 600 yards mentioned above as maximum range, reduced, by a quick bit of calculation, to 18 in. on the battlegame table.

The machine gun was fine against enemy personnel, but something heavier was required by infantry when they had to mix it with armoured fighting vehicles. Round about 1943 the Americans produced the earliest anti-tank rocket launcher, popularly known as the Bazooka. This was followed by the British P.I.A.T. (Projectile Infantry Anti-Tank) and the German Panzerfaust. All had an extremely powerful punch, but their short range made them virtually ambush weapons, more so in the case of the P.I.A.T., which seems to have been effective up to about 100 yards or so. Maximum range of the Bazooka is stated to have been 400 yards, but this may be rather an overestimate. The German rocket-launchers were extremely powerful and in favourable circumstances their missiles were able to penetrate over 4 in. of armour at 165 yards. The favourable circumstances were, of course, its angle of striking its target and where it actually struck. I think it is reasonable to give a maximum range of 200 yards to both Panzerfaust and Bazooka, with 100 yards to the P.I.A.T. As we shall see, they are pretty well one-shot weapons, as, if the first one went astray, it would be followed by a most lethal spray of bullets from the tank at which it had fired. Ranges then—Bazooka and Panzerfaust—6 in.; P.I.A.T.—3 in. (It won't matter too much about the latter—we shan't be using it a great deal.)

Last of the infantry " heavy " weapons is the mortar, used by every World War II army in great numbers and in every theatre of operations. Its use is pretty obvious. It could fling its projectile high into the air to drop in " dead ground " behind a hill or a wood, and it could plaster whole areas with the most deadly effect. It could be used for direct fire—i.e. with the target in visibility range—or the heavier varieties could have their fire directed by " spotters " at much more distant objectives. Some of these big chaps were quite enormous, the Russians having mortars of an incredible 305 mm. calibre, but these really come into the " artillery " category and we shall consider here the smaller type, such as might be used by the heavy weapons platoon of an infantry battalion. Let us take three examples—the U.S. 60 mm., the German 81 mm., and the British 3 in. In general terms the maximum " mean " range of the three averages out to something like 1,600 yards or just over—and this, reduced to our Battlegame scale, is round about 50 in. Whether our mortars can be fired at this range would depend on visibility, unless spotters were available, but of this more later. For the moment, then, we shall say that maximum range for our infantry type mortar is 50 in. (Later we shall have a word to say concerning the heavier ones, such as the Russian 120 mm.)

We go right back to the other end of the scale for our final weapon—the hand grenade—leaving it to the end because it is projected by the individual rather than by an explosion. Obviously of very short range, it is used in close combat, say, to flush enemy infantry out of a building, a grenade lobbed through a window doing this rapidly and effectively. Its range ? This would depend on the man of course, but we have to have a " mean " so let us say 2 in. This is over sixty yards in effect, but 1 in. would be too short, I feel.

That's the lot, then, for infantry, so let us conclude with a summary of the above.

WEAPON	MAX. RANGE
Pistol/revolver	1"
Sub-machine gun	4"
Rifle	9"
Machine gun	18"
Bazooka/Panzerfaust	6"
P.I.A.T.	3"
Infantry mortar	50"
Hand Grenade	2"

Battle scene—heavy mortars in action, with transport and infantry coming up in the rear. (Figures by Airfix; vehicles by Rocco; house home made).

BATTLE

by Charles Grant

Part V—Artillery Range

BEFORE PLUNGING into the technicalities of artillery fire, may I remind the reader of the ground scale we have already established? It is very important in this connection, particularly when we discuss gun range in relation to the capabilities of armour-piercing shot and its effect on the target, whether this be armoured or 'soft skinned'. The scale was of course based on the concept that an infantryman can advance 100 yards in one minute, and, as his game-move on the battlegame table occupies this interval of time, it will represent 100 yards. We made this distance 3 in., the idea in mind being to have easily compared speeds for all moving objects—100 yards per minute being 3 m.p.h. Thus the game move in inches of any vehicle represents its speed in miles per hour.

With this point disposed of, we go on to consider heavier weapons than those already dealt with, to wit, the enormous variety of artillery pieces which, for simplicity, we shall try to reduce to a more limited selection.

First, let us look at long range fire with high explosive shell, to get an idea of what its function was, how it was employed tactically, and what was its range. Roughly speaking, field guns could be used in two ways, with the target either quite out of sight of the gunners, or in actual visibility, whether that was unaided or with binoculars. I don't suppose that firing "over open sights" with H.E. shell was all that common in our chosen period—World War II—this meaning that the gun commander had a direct personal view of the target and was able to lay down fire thereon, making the necessary corrections from his own observation. Far more often gunfire was directed by a forward observer, either airborne or perched on some vantage point whence he had a good view of the enemy and was in touch with his guns by field telephone or by radio. Basically, he would see the enemy at a particular point, note that position with reference to a map, radio back for a 'shoot' on that spot, and then correct it until the shells were falling on the point desired. The Forward Observer's job was somewhat fraught, for it was the urgent concern of the enemy to silence him, by shooting him down were he in an aircraft, or eliminating him by ground attack. In such cases, without the benefit of the Forward Observer, the guns were virtually useless, for long range work at least.

An alternative was for artillery to fire on pre-determined targets on ranges calculated in advance from maps or on previously obtained reconnaissance information—all this without the assistance of a Forward Observer. This of course precluded observation of any results and tactically would be a defensive measure. An advancing army would have less knowledge of topographical detail than one which having retreated through a certain area would have been able to determine ranges with accuracy and to pick out the most advantageous areas to saturate with fire. This was the true function of artillery—in this role—to fire patterns of shot on an area, in fact to 'plaster' it with shells over a period, to the considerable discomfiture of whatever might be therein. One can think of a road junction which, having fallen into enemy hands, might be worth attention. If no Forward Observer were available to report casualties, accurate fire at irregular intervals would snarl up traffic if not necessarily destroying it.

Modern artillery, including that of World War II, has a pretty prodigious range and although we are not going to consider at the moment the really large calibre types we are still faced with a small problem. If we take three fairly typical guns of our period—the British 25-pounder gun-howitzer, the German 105 mm. field howitzer and the Russian 76.2 mm. field gun, we find that their maximum effective ranges are slightly different, but average out at about 12,000 yards (this being an approximation). A quick calculation will show that this amounts in terms of our battlegame scale to a somewhat terrifying 30 feet! It goes without saying that even the most fortunate of players do not have a table allowing artillery to be in position thereon and still fire at its maximum range of 30 feet. My own is 9 ft. by 7 ft., or, to scale, 3,600 yards by 2,700 yards, while the largest I know of is 12 ft. by 8 ft. By this token we see that field guns in 'Battle' will be able to cover the entire table and in fact need not be actually in position on it. They can be assumed to be just off the table with their fire being directed by a Forward Observer who must of course be on the table and in visual range of the target. Not that there is any reason for the guns not being on the table. They could be well in the rear with their firing properly controlled from a forward position.

We rule then that field artillery fire of the kind we have described has unlimited range when controlled fire is operating, with the target seen by the observer—this will normally be a fairly substantial distance, this chap being certainly equipped with powerful field glasses. Even so, it will not be the same in a fog as it would be in bright sunshine, but this question is bound up with the weather and will be considered separately.

The other type of artillery fire to be looked into is that when armour-piercing shells are used, usually against armoured fighting vehicles. This is not a matter of deluging an area with H.E. but of picking out a target object and of hitting it directly with one's fire. This is almost always a matter of direct fire, the difficulties of guiding an armour piercing shell onto a target that is out of sight being readily apparent. Tanks, naturally, could be called upon to fire H.E. shell in a conventional artillery role.

The first point about anti-tank firing is that the range is enormously less than when H.E. is used, for two reasons. It is almost invariably direct firing, with the range thereof necessarily being within existing visibility and, second, there is a limit to the range at which even armour-piercing shell will be effective against a heavily protected tank, for instance. In the

hope that by so doing we shall make things relatively simple we shall take the best conditions of visibility and use this as a base for an optimum of ' hit probability ' which can be scaled down as circumstances dictate.

When we speak of maximum A.P. range we don't mean the greatest distance the shell will travel, but that at which it can penetrate and possibly destroy. We shall later find that penetration is affected by the thickness of armour and the angle at which the shell strikes, but of this more later. Maximum A.P. range will be based on penetration of a given thickness of armour, taking the angle of strike as being the best possible in every case.

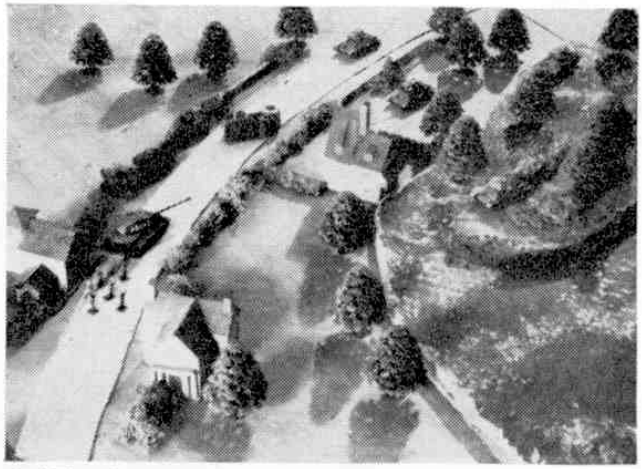
Just for a change, we shall begin with the big fellows, instead of with the small ones, the first of the former to come to mind being the celebrated German " Eighty-eight "—the 88 mm. PAK. This gun—in the anti-tank role—probably did more damage than any other in the service of the combatants in World War II and was truly a terrific weapon, its power making it capable of knocking out practically anything that came against it at a range of over a mile. Given the requisite visibility we can say that its greatest effective range was 2000 yards. A quick conversion and we get a ' Battle ' table range of 60 in. This again is a pretty terrific range for a table which might not be of the largest, but after all, this does imply unimpeded visibility, and certainly in fighting which simulates the conditions of Western Europe particularly, terrain irregularity, woods and so on will ensure that it is a pretty uncommon thing for an 88 mm. to get a shot at an enemy at this range—indeed it will say little for the latter's tactical skill if it *does* happen. Add to all this the fact that the first shot does not always strike home and before a second can be got off, an uncooperative enemy will doubtless have made himself scarce with some alacrity.

Maximum range for the ' 88 ' then is 60 in. and this will also do for the next " Big 'un "—the British 17-pounder anti-tank gun. This was also extremely powerful although, like the previous gun, its length and general size made it a fairly awkward thing to manoeuvre when it was used as a towed piece in close country, like the Normandy ' bocage ' for example.

Coming down the scale a little we find that the Germans had two guns of 75 mm. calibre, a ' short ' and a ' long ', this referring to the length of their respective barrels. The latter was an excellent gun, with a range of 1500 yards, while its shorter brother's was but 1000 yards—these figures converting to 45 in. and 30 in. respectively. The British 6-pounder and German 50 mm. A.T. guns are next for assessment and their range can be equated to that of the ' short ' 75 mm, although their penetrative power will be seen to be quite a bit less. The American 76 mm. as fitted to later Shermans was also a good gun—maximum range 1500 yards—or 45 in. As for the Russians, they had the weapons mounted in the two varieties of T.34 tank—76 mm. and 85 mm. The former's ' Battle ' range we can take as being 45 in., the latter's 60 in.—pretty deadly again. The Russians had also a 57 mm. gun—range similar to that of the German 50 mm.—30 in.

I realise that there are very many others that could be mentioned but those instanced are really enough to be going on with, although finally, I should say that normal field guns could be used in the anti-tank role at a pinch, if equipped with A.P. shell, the British 25-pounder having a range as such of 1000 yards—30 in.

Let us conclude with a recapitulation of the ranges we have set down above.

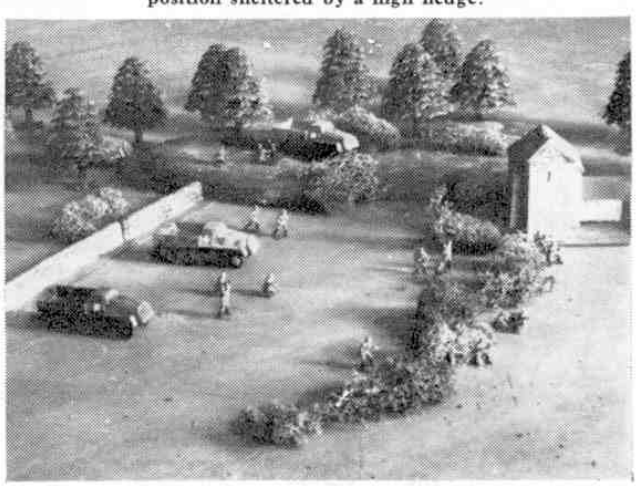


A ' Tiger ' running into a bit of trouble—a careful look and no less than four T.34's can be seen lurking in ambush.

	Weapon	Nationality	H.E. range	A.P. range
Field guns	25 pdr.	British	unlimited	30"
	105 mm. fld. howitzer	German	unlimited	—
	76.2 field gun	Russian	unlimited	

	Weapon	Nationality	A.P. range
Anti-tank guns	88 mm.	German	60"
	17 pdr. A.T. gun	British	60"
	75 mm. (long)	German	45"
	75 mm. (short)	German	30"
	76 mm.	U.S.A.	45"
	76 mm.	Russian	45"
	85 mm.	Russian	60"
	50 mm.	German	30"
	6 pdr.	British	30"
	57 mm.	Russian	30"

After deployment from half-tracks, infantry deploying into position sheltered by a high hedge.



BATTLE

by Charles Grant

Part VI
—The Defensive Power of Armour

WHEN AN armour-piercing shot hits a tank, or any other vehicle for that matter, what happens is dependent on a great variety of factors, of which the most readily apparent are—the calibre of the gun which fired; the range involved; the type of shot; the angle at which the target is hit and the thickness of the metal skin. The last, as we know, can range from the immensely strong and thick frontal armour of a 'Tiger' tank, which will obviously take a considerable wallop before being even dented, right down the scale to an unarmoured truck which, for practically any type of armour-piercing shot, is pretty much of a pushover. Now all the factors specified above will be taken into consideration, but first we have to deal with the last we mentioned—the armour value of the target vehicle.

The most cursory glance at the specifications for any fighting vehicle shows at once that there are many varying thicknesses of armour to be met with on any one tank, and different 'marks' of the same one may vary quite considerably in the armour of some particular section thereof. Almost invariably the front of a tank is more heavily protected than the remainder—theoretically, this is the aspect most usually turned towards the enemy, and it might provide a boost to the morale of the crew and dissuade them from turning their backs to the foe! Here and there it will be found that the manufacturer's idea of what was deemed adequate protection was found insufficient by the fighting men and additional armour plates were bolted on to a tank. This was seen in a number of World War II A.F.V.'s —heavy plates fixed to the sides, overlapping the tracks, always a vulnerable feature of a tank, where a shot might easily immobilise, if not necessarily destroy. The turret, too, being a high priority target, was also heavily armoured, although again the emphasis was normally on the frontal aspect. Roof armour of both chassis and turret were naturally lighter than that of both front and sides.

If we established a set of rules making immediate allowance for all the enormous number of armour variations to be found on even the limited number of tanks we are going to use in "Battle" the result would be too complex by far—we should have to draw up a set of tables as complicated as any volume of logarithms and, if we added the additional factor of the inclination of the armoured plates one to the other, we should be quite hopelessly bogged down. Nevertheless, as I hope the reader will be patient enough to learn as time goes on, we shall indeed have rules which will give reasonably appropriate effect to the particular point of a tank struck by a shell and to the angle at which it hits.

It is an extraordinary thing that, even with such a recent period of military history as World War II, we still get varying and often conflicting statements of fact relating to actual constructional details of such things as tanks, etc. One rather expects this when doing research on earlier periods, the Napoleonic Wars and so on, but with so much data available, it is a little surprising when two different and seemingly reliable sources give apparently different figures for—to quote an example—maximum armour thickness of a Panther tank. The numerous modifications of this vehicle might explain this away, so might varying types produced by different firms to requirements not always the same. Still, not to worry, what we are primarily concerned with is the *relative* defensive strengths of the A.F.V.'s we are using and if we can say, if only approximately, how the defensive power of the Panther compared with that of the Sherman, how the latter compared with the armoured half-track, and so on, we are pretty well home and dry.

Perhaps if I give one set of comparative values from a single, easily obtained source, the basis of what we are trying to achieve can be found. This is from a very readable book—if not the most technically detailed—"Tanks in Battle", by Colonel H. C. B. Rogers. What in fact we need is a *defensive value* for all the tanks and other vehicles appearing in our game. Some, such as the jeep or the truck, will have next to nothing in this connection, others, like the Churchill and the Panther, will have very large ones. Here it is then as given in an appendix to the book to which I have referred.

Tank	Nationality	Maximum Armour Thickness
Panther	Ger.	120 mm.
Churchill	Br.	100 mm.
PzKw. IV	Ger.	85 mm.
Sherman	U.S.	76 mm.
T.34	Russ.	75 mm.

This list may not indeed be acceptable to many a military purist, but I give it as printed. It seems that the figures refer to the greatest thickness of armour for each type in use towards the end of World War II but, in any case, it provides a good basis for comparison.

It will be seen that I have included the German tank —the PzKw IV—whose details were omitted from the previous article on tank speeds, etc. The decision to bring in the Mark IV was prompted by the thought that the Panther—the Mark V—which I had originally intended to be the sole German representative, was far stronger defensively than the tanks of other nationalities. This would have resulted in a very unequal fight were it included in future battles against the smaller fry. It would be pretty unfair to a battlegamer with possibly an American army using Shermans to pit him against a German one with the terrible Panthers. Hence the details of the Mark IV, for which the Sherman was a reasonable match. We can give a few details concerning the PzKw IV to bring it into line. We shall employ the one armed with the long-barrelled 75 mm. gun, whose speed was similar to that of the Sherman and which can consequently be converted to battle-game table moves of 12 in. on roads and 6 in. across country.

Taking the foregoing list further down the scale we come to the more lightly armoured types, the self-propelled guns, the half-tracks and armoured cars, and last of all the jeeps, trucks and other soft-skinned vehicles. Once again we give—this time from a number of sources—the maximum armour thickness as a guide to their defensive capabilities.

Vehicle	Nationality	Maximum Armour Thickness
Sturmgeschutz III (S.P. gun)	Ger.	50 mm.
Sdkfz 234 (Heavy armoured car)	Ger.	30 mm.
A.E.C. Armoured car (heavy)	Br.	30 mm.
Sdkfz 231 (Light armoured car)	Ger.	14.5 mm.
Humber Armoured Car (Light)	Br.	15 mm.
Sdkfz 251 (Half Track)	Ger.	12 mm.

Together with the previous list, this should be enough to be going on with, and we conclude with the ordinarily unarmoured truck or jeep whose defensive value, with next to no protection, is relatively about nil.

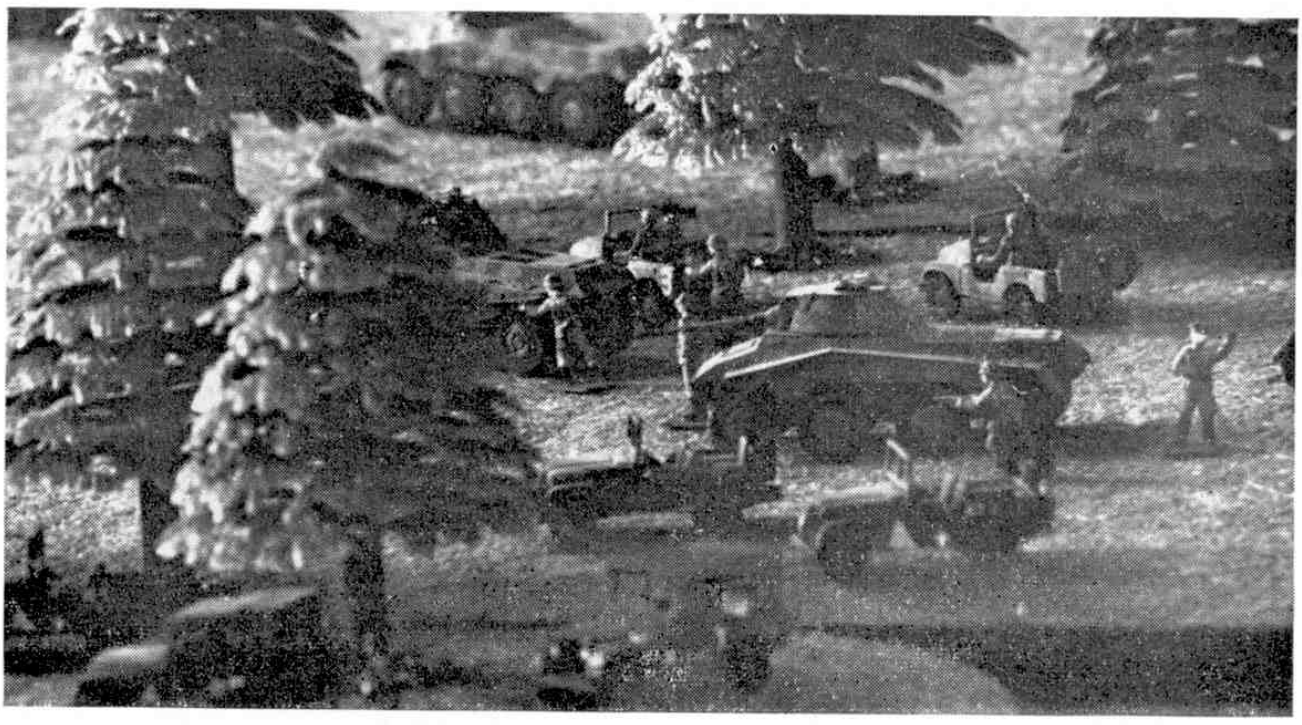
Now, from all this wealth of data we can work out a table of comparison values to indicate the defensive power of the vehicles used in " Battle ". Let me elaborate just a little on what we are aiming to do, and this applies initially to a tank versus tank battle, or at least an engagement between a gun firing armour-piercing shot and some kind of vehicle, more or less protected by armour. The process is simple—the gun fires at the target, the first problem being to hit it. If this is successful and the shell makes contact, the result—in the simplest sense—is determined by the difference between the penetrative capability of the shell and the toughness of the defensive armour. We have then to work out a rule which has two variables—the Defence Value of the target and the Strike Value of the gun. The result of this calculation—plus certain other factors—will determine whether the shell penetrates or merely glances off, causing little or no damage. Obviously one of the lighter A.T. guns is going to have no effect on the massive armour of a Tiger, and conversely, an 88 mm. or 17-pounder will make mincemeat of a lightly protected armoured car.

The scale of defensive values we lay down will be based then on the maximum thickness of armour for each vehicle. I shall have to ask the reader to accept the values given as being the products of some considerable research together with the experience gained from many games on the table. Let it suffice to say that the theoretical side is governed by research into the capabilities of various types of shell and the ability of armour to resist attack, these things being regularly tested on army proving grounds. Nothing is certain, though, and, as we shall see, the element of chance is far from being absent.

Enough preamble, however, and we conclude with our actual table of Defence Values, concerning which there will be further discussion in the next issue.

Vehicle	Defence Value
Panther	18
Churchill	15
T.34	14
PzKw IV	14
Sturmgeschutz III	13
Heavy armoured car	12
Half-track	11
Light armoured car	10
Truck or Jeep	6

Ill-met by moonlight! A recce, group of scout cars and armoured cars taking up a position in a wood.



AMONG THE MODEL BUILDERS

Continued from page 605

Now secured in the centre transverse bore of Coupling 7 is a 1½ in. Rod on which a free-running ¾ in. Pinion 9 is held by a Collar. This Pinion meshes with both Contrates 6 and 8 so that, when the input shaft is turned, the Pinion travels round fixed Contrate 6, revolving as it does so. This, in turn, causes Contrate 8 to revolve, but at twice the speed thus resulting in a 2 : 1 ratio.

PARTS REQUIRED

1—15a	2—28	2—45	2—59
1—16	10—37a	1—48b	1—63
1—18a	8—37b	1—53	2—72
1—25	3—38		

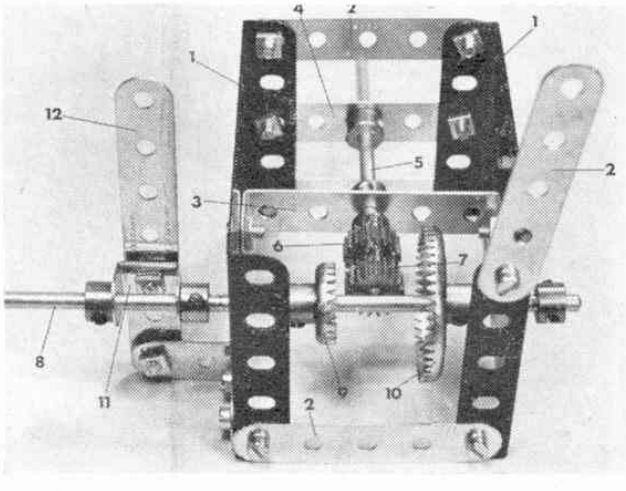
Reverse Gearbox

Finally we have our other pre-war mechanism which is a Two-speed Reverse Gearbox. A framework is built up from two 3½ × 2½ in. Flanged Plates 1 joined by four 2½ in. Strips 2, one at each corner. The centres of the Plates are joined by a 2½ × ½ in. Double Angle Strip 3 which, together with another 2½ in. Strip 4 positioned as shown, provides the bearings for a Rod 5 on which two ½ in. Pinions 6 and 7 are mounted. A second Rod 8, free to slide in its bearings, is mounted in Plates 1. A ¾ in. Contrate 9 and a 1½ in. Contrate 10 are fixed on the Rod, movement of which should bring Contrate 9 into mesh with Pinion 6 or Contrate 10 into mesh with Pinion 7. The Rod is actuated by a Double Bracket 11, held between two Collars and lock-nutted to a 3½ Strip 12. This Strip is itself lock-nutted to a 1 × 1 in. Angle Bracket bolted to one Plate 1.

PARTS REQUIRED

1—3	1—14a	1—29	1—48a
5—5	1—15b	18—37a	2—53
1—11	2—26	16—37b	5—59
1—12a	1—28		

This Two-speed Reverse Gear-box is yet another example of a mechanism, first featured in the pre-war Standard Mechanisms Manual, which is just as useful today.



BATTLE

Part VII—The Use of Dice

by Charles Grant

HAVING TAKEN care of the Defence Value in respect to tanks, etc., the obvious thing to do is to follow up with a consideration of Attack Value of armoured fighting vehicles and to draw up a comparative table of the powers of the anti-tank guns whose ranges we have already discussed.

However, it might not come amiss at this stage before doing so, if we digress a little in favour of one very important point in "Battle". This concerns dice —how and in what circumstances we use them, and what effect they can have on the progress of the game.

First of all, the novice beginner in the study of the military art—of whatever period you like—quickly comes to the pretty obvious conclusion that, to control the actions of a unit or even of a few individuals in any sort of engagement is a very chancy and uncertain business. Someone once wrote that the conduct of military operations is an art rather than an exact science (or words to that effect) and nothing is truer at every stage and in every section thereof. It is believed that Napoleon was pretty off-colour on the day of Waterloo, and, because he was not feeling over perky, allowed his less competent generals to commit some dreadful boobs he would never have permitted had he been a hundred-per-cent fit. This is one end of the scale, when, on one occasion, a man's physical condition may have the most far-reaching effects on the conduct of great armies and the result of important battles. At the other extreme you might have a tank gunner, peering through his sights at an enemy and about to draw a bead on him, when a trickle of perspiration—it's hot inside a tank—rolls down his forehead and into his eye just at the psychological moment, causing his lining up of the target to be just a little out and converting a direct hit into a near miss when he lets fly before he was really ready. What I'm getting at is the fact that nothing—absolutely nothing—is dead certain in a battle or a campaign and always one must allow for what might be called the 'imponderable' (an impressive word, is it not?) which we can translate as plain, down to earth luck, good or bad. If "Battle" is to be a reflection of the conditions of the 'real thing', then, the rules must give proper allowance for this factor of uncertainty.

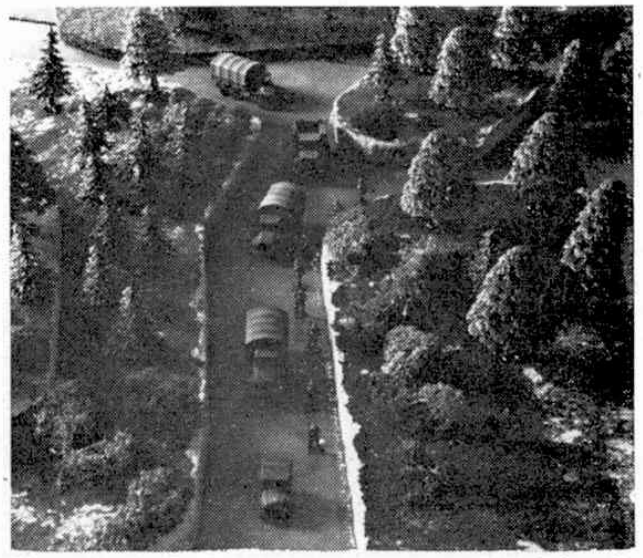
What it comes down to is that warfare is far from being as mathematically accurate as a game of chess, where the player moves his pieces in predetermined patterns. In "Battle" the pieces can move in all sorts of surprising ways, and not infrequently even refuse to obey the dictates of the player (although the latter can 'in extremis' decide to heave the table over—and it has indeed been done, but only by the more emotional type of battlegamer). So in "Battle" we attempt to simulate the 'imponderable' that obtains in 'the real thing' by having recourse to the use of those time-honoured cubes—the dice. Or if I may be pedantic, in the singular—the die. (These are, in passing, the ordin-

ary number type, not the ' poker ' variety). It must not be thought, however, that the game is completely controlled by chance—in the shape of the dice— any more than an actual battle is completely dominated by Dame Fortune. The process takes place only within a certain framework beyond which it cannot extend.

Let me quote an example to show what I mean—I apologise for using one right out of our period and I hope that I may not be unduly castigated for doing so. Let's go right back to the days when a regiment of infantry stood in line ' in close order for firing ' blazing away at another such unit about sixty yards away. If the whole lot delivers a volley, what are the two extremes of possibility ? They are as follows—(a) every man in the regiment firing will miss completely, or (b) every musket ball will strike home. Neither is at all likely, but if one considers a sizeable number of such volleys, there will emerge an average number of hits per volley. This will provide a fairly consistent pattern although, from time to time, there will be the occasional ' spread ' above or below the ' norm ' when one will create enormous havoc or, in contrast, will result in few or no casualties. All we can say, regarding any very great deviation from the average, is that it is governed by a multitude of factors which, in this case, amounts to nothing more nor less than luck. The training and ability of the men firing, their morale, whether they are cold or hot, their state of fatigue—all are facets of the same ' imponderable '—or just simply luck. What we must have then, in a battlegame of this period, is a firing rule which will usually give a fairly average result, but which can also cope with the occasional extreme either way. These are basically the conditions which form the framework of any rule which includes the element of uncertainty.

I heard a television interviewer once suggest that the use of dice made battlegaming on a par with Snakes and Ladders and such like games of chance. Well, he was being just stupid, or trying to take a rise out of his guest. It is in fact the imponderable which does give reality to " Battle " and, as we shall see, does cause the players to make proper allowance for the unlikely or even the seemingly impossible, which, as we read, did happen surprisingly frequently in the annals of war.

This is what makes " Battle " such a fascinating pastime, for in it we find so many examples of the old adage concerning ' the best laid schemes of mice and men, etc.' It will frequently happen in the course of a battle that, when a player has planned some brilliant tactical manoeuvre and is about to batter his opponent into abject surrender, the leading regiment of his outflanking column will take fright and run; his headquarters tank will break down, or fog will blanket his airfield so that his helicopters cannot take off. This is

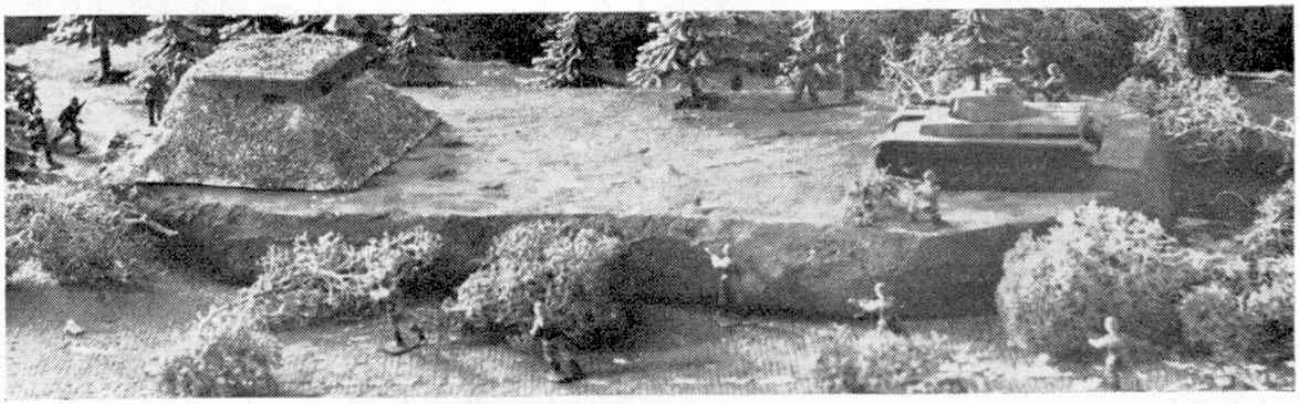


Above: Transport on the move in wooded country—it is to be hoped that some recce. had been done. Below: Attack on a block house—a tank and infantry in a combined operation.

naturally highly satisfactory when it happens to the enemy but incredibly infuriating when one is on the receiving end of such evil fortune.

Now that I have made—or at least I hope I have—my point about the significant part played by chance in both the ' real thing ' and in our game, I can throw in some preliminary remarks about what is to be considered next—the Strike Values of guns firing armour-piercing shell and how the effectiveness of such action is judged.

First of all, if the target is visible and in range, the gun will fire and a hit may be scored (the first element of doubt). If this happens the result of the strike has to be assessed. This is done in much the same way as, in the example mentioned already, we described how we calculated the result of a volley of musketry on a regiment of infantry. In the case of the A.P. shell it might bounce or ricochet off, doing no damage at all, or it can utterly destroy the target tank (or whatever vehicle it might be). This will be determined, broadly speaking, between the two factors of armour thickness (Defence Value) and the penetrative power of the shell —the Strike Value, together with one or two other points we shall take into consideration, plus—and this is highly important—the effect of the imponderable, i.e. luck. In the next article then we shall calculate Strike Values for our guns and get on with the business of finding out how the dice are used to assist in deciding what happens when a shell collides with a tank.



BATTLE

Part VIII—Strike values of Anti-Tank Guns

by Charles Grant

IN PREVIOUS numbers we established what we hoped was an effective schedule of the Defence Values of all our armoured fighting vehicles (with the regrettable exception of the Sherman tank, which was somehow overlooked—my fault, entirely—but which can be added to the table with a value of 14) and made a start with a discussion of the power and range of a variety of guns. Having also considered how the use of dice provides the uncertainty factor in "Battle", we must now make an evaluation of the effectiveness of the guns, and we shall then be well on the way towards getting some workable rules for the conduct of an armoured battle.

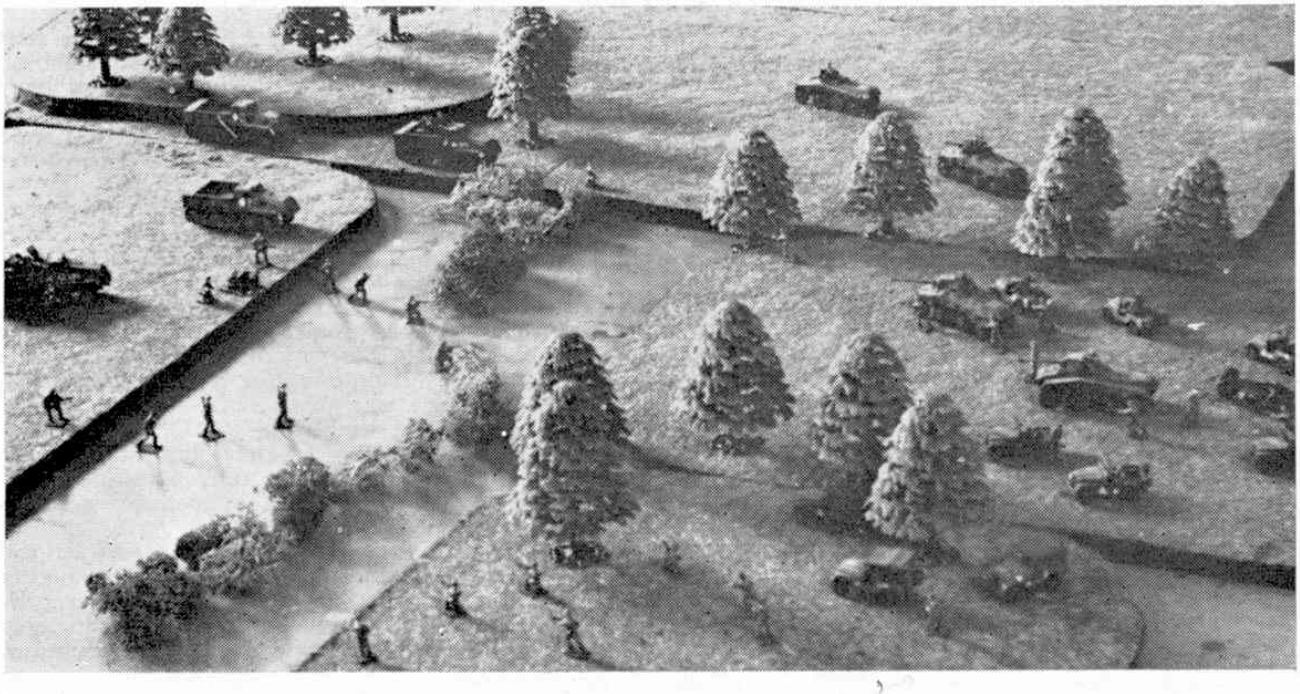
Now this is the sort of thing in which it is all too easy to become quite hopelessly embroiled. In drawing up these rules, which I again stress are 'basic' ones, as well as doing a heap of research on my own account I've been fortunate enough to have had access to the existing rules of certain battlegamers of great experience, particularly in this modern type. Such comparisons of other rules with one's own are very rewarding, but I found that some were quite frightening in their complexity, involving carefully drawn graphs, complicated calculations and goodness knows what else. This sort of thing is not going to be inflicted on the reader—this I can say right away. All I shall do is to demonstrate—as simply as possible—how the two values, those of Defence and Strike, work in conjunction with a variable, the dice effect, and then to give the appropriate Strike Values for the guns discussed in Part V, when we worked out various ranges for them.

Let us take as an example the German 75 mm (long) A.T. gun to which we gave a maximum effective range of 1500 yards—or 45 in. on the battlegame table. (In future we shall if possible refer always to the table range in inches rather than to that of the 'real thing' in yards). Having consulted various data charts on penetrative power of this particular weapon we find that at this range an armour piercing shell fired from it would penetrate about 75 mm. of armour thickness. I emphasise the word 'penetrate' because the penetration, while causing a considerable amount of discomfort, would not necessarily destroy the vehicle protected by this armour. In fact, at maximum range, the chances are that it would do precious little damage at all.

Having a look at the Table of Defence Values we see right away that the Sherman (we shall take it as an example to compensate for its not being included in the Defence Value Table in Part VI) has a Defence Value of 14—it has a maximum armour thickness of 76 mm. So, we have to give the 'long' 75 mm. gun an attack value which will give it—together with a dice throw representing the 'imponderable'—as nearly as possible the same chance of destroying the Sherman as it would have had in actual operations.

To use a single dice for this throw would reduce the range of possibilities most unrealistically, so we employ two, no less. We have then to gear the Strike Value to the fact that the maximum that can be thrown with two dice is 12. Suppose then we say, that at 45 in. range—maximum effective—the 75 mm. has a Strike Value of 4. This means that, to destroy the Sherman, the player whose gun is firing has to throw with two dice a total which, together with the given Strike Value, will exceed the Defence Value. With two dice, then, he must throw 11 to 12 to destroy the tank. We don't have to go into the realms of calculus to see that with two dice he has two chances of throwing what he needs—the 11 or 12—out of the 21 possible variations which can come up. So, roughly speaking, the chances of knocking out the Sherman at maximum range with one shot would be about one in ten, and this, in practice, seems to be about right (not forgetting

"Battle" is joined—a bird's eye view of a skirmish in progress —infantry and light vehicles being involved.



that at long range—as we shall see—it is by no means easy even to score a hit).

Needless to say, at closer ranges the Strike Value must naturally be increased and we have to establish some sort of rule of thumb on when to say that point-blank range becomes medium range and so on, without making the thing too complicated. If we take 45 in. as maximum effective range, we can divide this into four sections, thus—0 in. to 10 in., 10 in. to 20 in., 20 in. to 30 in. and 30 in. to 45 in. Continuing to take the 'long' 75 mm. as an example, at 0 in. to 10 in. its Strike Value will be 7, at 10 in. to 20 in. it will be 6, and at 20 in. to 30 in. it will be 3. At long range, as already seen, it is 4. On the face of it, at first sight there does not seem to be a great deal of difference between the various Strike Values, but nevertheless it will be found to be quite substantial. For example when one has to score 7 or more with two dice, there are no less than 12 possible combinations by which this may be obtained out of the total of 21. The possibility then of destroying our sample Sherman leaps up from one in ten at long range to over one in two at close range.

A tremendous amount of facts and figures exist to cover the effectiveness of every possible gun in every circumstance you can think of, but space does not permit even a resume of this, although all of it is very important as a background to why a certain gun has a particular strike value while a second has a slightly lower value, and so on. Such technical stuff can be pretty boring reading as well, so let it suffice to say that the Table of Strike Values is in fact the product of research plus lengthy trials in " Battle " where they —the Strike Values—seem to work satisfactorily.

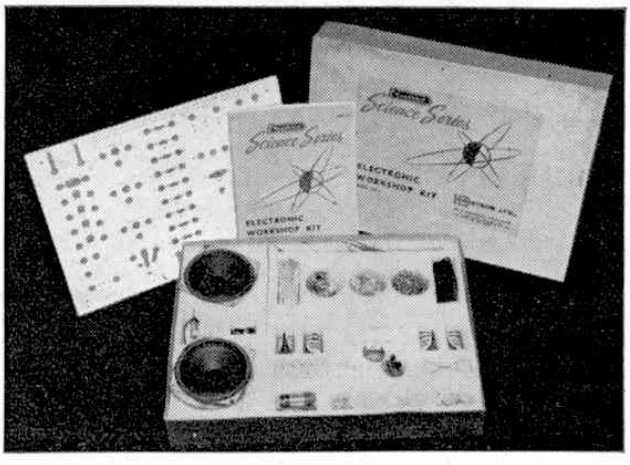
TABLE OF STRIKE VALUES

Weapon	Nationality	Ranges in inches			
		0 to 10	10 to 20	20 to 30	30 to 45
88 mm	Ger.	12	11	9	7
17 pdr.	Br.	12	10	8	6
85 mm	Russ.	11	9	8	6
76 mm	Russ.	8	7	5	4
76 mm	U.S.	7	6	5	4
75 mm (long)	Ger.	7	6	5	4
6 pdr.	Br.	5	4	3	—
75 mm (short)	Ger.	4	2	1	—
57 mm	Russ.	6	5	4	—
50 mm	Ger.	5	4	3	—

(NOTE—What we might call the " ambush " weapons —Bazooka and panzerfaust—will be dealt with later under the general heading of infantry weapons).

A few points should be noted concerning the Table, the first being that not every battlegamer will necessarily agree with the relative scale of values given, but it has been tested most thoroughly and does give a good idea of armoured warfare. It may be thought that I have been over generous to the defence, but I would point out that it was a comparatively rare thing in the time of which we speak to destroy a tank with a single first shot. Such things are fine in the cinema, but it was indeed a lucky gunner who, when first glimpsing

Continued on page 672



SIMPLE ELECTRONICS

Meccano Magazine staff member G. Blackwell reviews a Heathkit Science Series Kit

KNOWING THAT the majority of *Meccano Magazine* readers like things of a technical nature, and Christmas is in everyones mind, we decided to construct one of HEATHKIT'S educational Science Series kits. This particular one, the Electronic Workshop Kit EW-1, costs £6. 16. 0., and is advertised on page 629 of this magazine. The kit was designed not only to give the constructor many hours of enjoyment but also to give a foresight into the workings and principles of electrical circuits and components.

Today with the great number of electrical engineering opportunities for youngsters, one can never start to learn or supplement ones schooling in this subject too soon. This simple kit can teach you in a few hours what may take months in a classroom, and it is a well known fact, that by learning through practical work and not only theory, principles are remembered far more easily.

The kit contains over four hundred parts, these include a hardboard base board, with pre-drilled holes and all the terminal positions printed on it. This single board forms the basis of every experiment. Also included are transistors, capacitors, resistors, tuning coils, two 4 in. speakers, on/off switch and an earphone. Some 46 different pre-cut lengths of wire are included so you do not have to cut any yourself, just select the one you need. There are also 5 sizes of nuts, screws and washers, 4 Ray.O.Vac ILP batteries, battery mounting brackets and contacts, 72 terminal connector springs, a fully illustrated construction manual, and other components such as control nobs, etc.

The 72 page, 10 inch × 7½ inch size, constructional manual make electronics seems very easy, even a 12 year old can construct the most complicated experiment detailed in this manual. As well as giving step by step assembly instructions for the experiments, it