

ATCO

JUNIOR
SAFETYFIRST
TRAINER

*Manual of Training
and Discipline*

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JUNIOR
SAFETYFIRST
TRAINER

MANUAL of TRAINING
AND MAINTENANCE

Price 2/6

(First edition)

CHARLES H. PUGH LTD. WHITWORTH WORKS
BIRMINGHAM, 9

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ATCO

Junior

SAFETYFIRST TRAINER



FOREWORD

TO ROAD DRIVERS OF THE FUTURE.

Road accidents to-day are a bad blot on the country's copybook. Side by side with the immense advantages due to the invention and perfection of road vehicles, goes the shadow of suffering and enormous national waste and expense.

The cause is almost entirely the human element in driving, walking or cycling; not the machines themselves, or the volume of traffic.

Road drivers are drawn from every class, and this Manual is dedicated to them.

It is for the road drivers of the future that the Atco Junior Safetyfirst Trainer has been placed on the market.

WHY?

Well; pedestrian and cyclist road users are not only receiving education in road use, but experience is, as it were, beginning to be born in them—even domestic and other animals have developed "road sense" noticeably during the last 20 years or so.

If, with an improvement in the way non-drivers use the roads, there can be a general improvement in the skill, judgment and road sense of the drivers, then the blot can be almost entirely removed in years to come.

This belief is supported by my own experience and that of six brothers and sisters, who all went through the same mill.

I have driven in many countries and on numerous types of bikes, motor-bikes, cars and lorries, upwards of half a million miles, without an accident that counts. So, more or less, have my brothers and sisters.

There is a reason for this—in addition to our fair share of good luck. We all rode motor-bikes and drove cars at home before getting licences at 14 (for bikes) and 17 (for cars).

And when we went out on the roads there was, compared with modern conditions, practically no traffic and very few road regulations to observe.

We all made numerous errors of judgment and other mistakes, but a slice of luck and the absence of traffic enabled us to do so without serious mishaps. Thus we had learnt all the difficult part—*control and judgment*—long before traffic became heavy.

IT WOULD BE WRONG AND ILLEGAL AND IMPOSSIBLE TO LEARN IN THAT WAY NOWADAYS; indeed, it was only possible in our case because of an indulgent father who made motor cars, motor-cycles and bicycles.

And yet, in a similar training of all who are going to drive later on—and that means everybody—lies the best hope of a solution of the problem of road accidents to-day.

The Atco Junior Safetyfirst Trainer is therefore exactly what it is called, a Trainer on which it is possible *for every young person* to have general driving (as opposed to walking or riding) training, off the roads and in safety, and at a trifling cost.

It is a serious small Trainer, requiring the use of all the faculties necessary—

- (a) For safe use of the roads as a driver ;
- (b) For grasping the elementary engineering principles of power-propelled vehicles so essential to every youngster in these days.

You cannot be a first-class driver unless the actual control of the car, lorry, tractor, bus, aeroplane, is absolutely second nature to you.

It is the sincere hope of this Company—who have served the British Public with their Atco Motor Mowers for 20 years—that the introduction of the Atco Trainer will play a real part in the educational system, private and public, of the nation.

In addition, we hope that the little Trainer will provide amusement and happiness in healthy outdoor surroundings, for young and old alike.

Lastly, I should like to thank all those who, believing in the rightness of this whole scheme, have helped to produce the Trainer itself and this publication.



Managing Director.

CHARLES H. PUGH, LIMITED,
WHITWORTH WORKS, BIRMINGHAM, 9

Sole Makers of Atco All-British Motor Mowers. Originators and Sole Makers of Atco Junior Safetyfirst Trainer.

I TRAINING

(1) INTRODUCTION.

Nobody knows better than we, who practically supply the country's needs in motor mowers, how little attention is paid to our carefully written Instruction Books. Also, nobody knows better than we, the amount of annoyance, expense and waste which is caused to users in this way.

So please study and study this book until you have mastered it fairly and squarely, which won't take long.

In the meantime, use your Trainer as little as possible and preferably with the interested supervision of a grown-up.

Afterwards keep the book in its proper place on the Trainer, and refer to it as occasion demands and to us without hesitation for any further information.

The message of this introduction is so important, if you are to get the value you should from your Atco Junior Safetyfirst Trainer, that we have repeated it again at the beginning of the second section of this Manual.

Never forget it, because it applies to most of the important purchases you will make all through your life. Makers supply Instruction Books with new products in an earnest desire to enable the user to obtain results which will enable him to speak well of his purchase.

INTRODUCTORY REMARKS TO TECHNICAL DESCRIPTION

(2) HOW THE TRAINER WORKS.

The following notes are written in order to give you a simple description of the technical details of the Atco Junior Safetyfirst Trainer, but at the same time it is hoped that they will lay the sure foundation of a desire for knowledge and a spirit of interested inquiry in connection with much more complicated types of vehicles with which the reader may be brought into contact in future years :—

Although modern motor transport manufacturers can now boast of the magnificent reliability of their vehicles, and in spite of the fact that their products seem to get more fool-proof year by year, it is surprising the added interest and enjoyment to be found in driving, either for business or pleasure, when one knows to a certain extent what is taking place in that mysterious area usually covered up by either floor boards or bonnet.

The need for knowledge of the "why and wherefore" is to-day a positive necessity, and will in any event help you out of many a difficulty. You are also more ready, under these circumstances, to appreciate the thought and skill expended upon the design and construction of the machinery of which you are in charge, and to take care that these efforts are not brought to nothing by the effects of brutal or careless usage.

You will find that if you regularly attend to the wants of any motor vehicle of which you have charge, and make a study of its peculiarities (for every car built seems to have an individuality of its own) it will give you in return a long period of good and faithful service.

Now, let us start to investigate the secret recesses of the little Trainer in question and see what is there to interest us.

First and foremost, of course, comes the Engine.

In common with most of the rising generations of the last half century, your interest in engines up to the present has, most likely, been centred in the railway locomotive.

You have probably watched these wonders of Modern Engineering getting away with their immense loads from one of our principal stations, and perhaps marvelled at the powerful unseen force driving the piston rods to and fro, in and out of the cylinders. Most of you also, will have sought for information and either read or been told of this wonderful force due to the expansive power of steam generated in the boiler of the locomotive and kept up to full pressure by continual work on the part of the fireman with his shovel.

Now it was realised, very early on, by motor engineers that they would have to do something entirely different to this. The inconvenience of a boiler with its attendant supplies of water and fuel could not be entertained. So the question arises :—What shall we use which will give us the advantages of the expansive power of steam without some of its drawbacks? The answer is “Air.”

This is present all round us, for without it none of us could live, and we have an engine which is only too willing to spend part of its time pumping it in, provided that for this small service it is granted a fresh supply of power to enable it to continue doing its main job. But air as taken direct from the atmosphere would be of no service to us until we have found some means of raising its temperature and pressure so as to make use of its expansive properties.

This is done by mixing the air on its way to the engine cylinder with a correct proportion of vaporised petrol.

This mixture, when compressed between the top of the piston and the roof of the cylinder and ignited at the right moment by an electric spark, rises with extreme rapidity in temperature, and therefore in pressure, and in its hurry to expand down again to the pressure of the surrounding atmosphere, forces the piston down the cylinder, giving us our much desired power.

Owing to the fact that the ignition of the mixture takes place inside the engine cylinder, this kind of engine is known as the Internal Combustion type.

Most of you will have noticed that any piece of machinery requires lubrication at regular intervals (for instance, your bicycle or lawn mower), in order to make it run easier and to prevent the moving parts from wearing out too quickly. This definitely applies to our engine, and is carried out by mixing a small proportion of a high-class lubricating oil with the petrol before filling the fuel storage

tank. This oil then passes into the engine with the petrol, effectively lubricating the moving parts.

Large engines have separate oil pumps and sometimes oil coolers so that the oil which does not happen to get used up, can be drained back out of the engine and circulated again and again. In our small engine, however, such complicated apparatus is unnecessary.

As we cannot utilise our gas pressure without enclosing it, *i.e.*, in the inside of the cylinder, we must unfortunately lose valuable heat to the surrounding metal walls, and if special precautions were not taken to prevent it, we should find after a period of running at a fair number of revolutions per minute, the amount of heat had kept on piling up to such an extent that the lubricating oil, however good it was in the first place, would lose its lubricating properties, and finally all the moving parts in the engine would come to grief, both because they had become so hot themselves, and also for lack of efficient lubrication. You will notice therefore that the cylinder of our engine is formed with thin "fins" or webs of metal all round the outside and across the top. These are plainly indicated by the letter (H) on Figs. 1 and 2 on pages 18 and 21, and their use is to give a large extra surface so that excess heat is taken away by the ever changing air surrounding the cylinder.

Larger type engines are made with water jackets so that a supply of cooling water may be circulated round the cylinders, but our little engine, in common with the great majority of smaller single cylinder engines, is of the Air-cooled type.

We must now look into the question of starting up our engine. Going back again to the locomotive, you have no doubt watched the engine driver, when the signal to start has at last been given, move a lever inside the cab which opens the throttle valve and admits high pressure steam from the boiler to the engine cylinders. Unfortunately for us, we have no container full of high pressure air to draw upon, and therefore we have to supply the starting effort ourselves until such time as a proper mixture of gas is in place over the top of the piston and the first ignition has occurred.

After this has happened our engine will run merrily on, performing all the necessary operations automatically as long as supplies of petrol and air are forthcoming.

You will see the starting handle which is a lever just above the floor boards between the two seat cushions. On the other end of this lever is a quadrant fitted with a number of rollers (similar to those of a roller cycle chain) and these mesh in with the teeth of a free wheel fixed on to one of the engine unit shafts. This free wheel is exactly like those fitted to the hub of the push bike, that is to say it will carry its shaft round with it if moved in one direction, but will slip back if turned the opposite way.

When the starting handle is pulled up sharply, the quadrant is depressed and the rollers fitted to it pull round the free wheel and its shaft thus turning the engine shaft. The free wheel allows the starting handle to be dropped back on to the floor boards ready for another pull up if

required. The number of pulls required to start the engine will largely depend on whether the latter is cold or whether it has recently been used and is still warm, and also (don't forget this whatever you do) whether you have turned on the tap of the petrol supply pipe.

We are now in a position to take a somewhat more detailed survey of the working of the engine together with its main components, the carburetter and ignition gear.

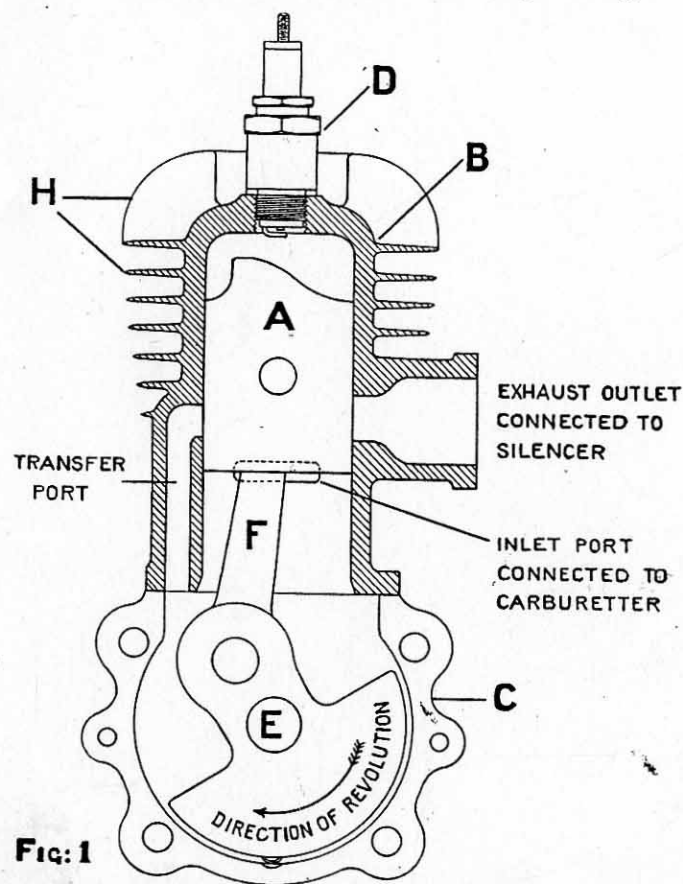


Fig: 1

ATCO VILLIERS ENGINE AS FITTED TO THE TRAINER

EXPLANATION OF THE TWO- STROKE CYCLE

The first drawing, Fig. 1, shows the piston (A) moving upwards in the cylinder (B), and a charge of gas which is a mixture of Air and Petrol and Oil, called Petroil, in proper proportions, being compressed.

The upward movement of the piston is also causing a depression or partial vacuum in the crankcase (C). As the piston nears the top of its stroke, the bottom of the piston uncovers a port near the bottom of the cylinder which is called the inlet port; this is connected with the carburetter through which, when the port is uncovered, the air rushes, taking with it the proper proportion of petroil into the crankcase, ready to be compressed for the next charge to be transferred to the top of the piston. While this is going on under the piston, and shortly before the piston reaches the top of its stroke, the compressed charge above the piston is ignited by an electric spark, which jumps across the points of the sparking plug (D). This causes the charge to expand very rapidly, and forces the piston down and so forms the power stroke.

As the piston is forced downwards thus supplying the power to turn the crankshaft (E), by means of the

connecting rod (F), it is also compressing the charge which has entered the crankcase.

When the piston is nearing the bottom of its stroke, Fig. 2, the top side of the piston uncovers a port in one side of the cylinder called the exhaust port, which is connected with the exhaust pipe and silencer, and the burnt gases rush out aided by the deflector shape of the piston top. At nearly the same time another port on the opposite side of the cylinder is uncovered by the piston. This port is connected direct to the crankcase and when it is uncovered the compressed charge in the crankcase rushes in and is deflected upwards into the cylinder by the deflector on the piston top. The piston moves up and closes all the ports, then starts to compress the mixture, and we have arrived back from where we started and completed the Two-stroke Cycle.

THE MAGNETO

The magneto is an instrument which ignites the compressed charge in the cylinder. The spark for doing this is made by moving a magnetic field across a coil and creating a very high voltage spark.

A condenser, which is a number of tinfoil plates insulated from each other, is fitted to prevent the burning of the tungsten points.

The ignition coil is actually a spool of wire with each of its many layers insulated from the other by means of

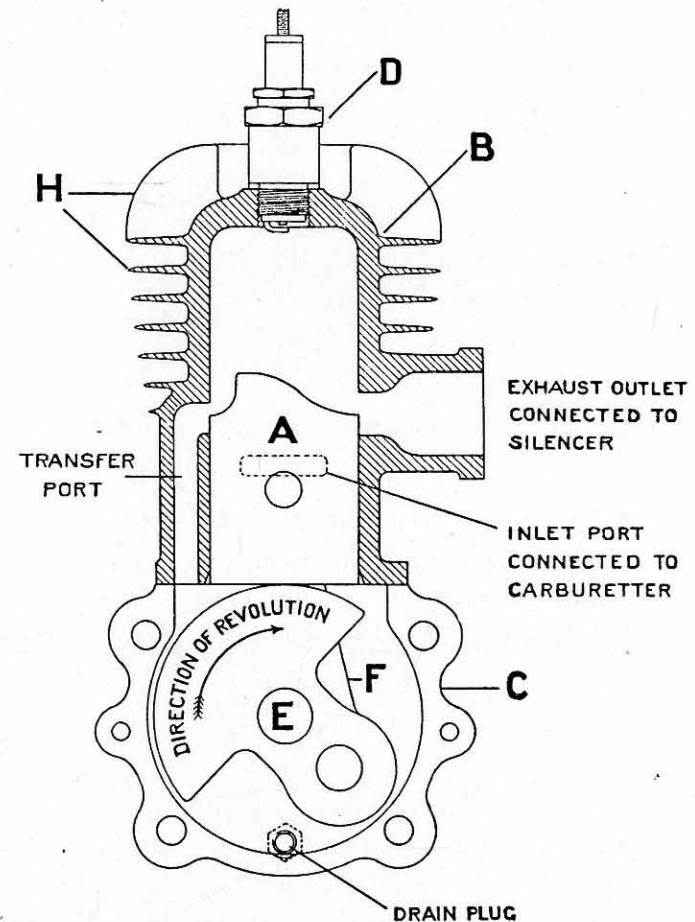


Fig: 2

varnished silk, and is carefully sealed to avoid the introduction of moisture.

In trying to understand the working of a magneto it is necessary to take for granted the invisible power of the magnets, which when passed like a magic wand over the coil produces a powerful current which is guided by means of insulated wires to the sparking plug.

THE CARBURETTER, Fig. 3

We now come to the Carburetter, and we will try to explain how it performs its duty of providing the proper mixture of vaporised Petroil and Air in the desired quantity for the engine.

You will remember when describing the engine we mentioned a depression or partial vacuum being caused in the crankcase as the piston moved upwards. When the piston was at the bottom of its stroke, there was a fixed area or space in the crankcase, the contents of which were at atmospheric pressure, which is approximately 15lb. per square inch.

When the piston ascends, it closes all ports and there is no way for anything to get in, so the piston displaces or stretches the air or gas inside until it is at a much lower pressure than the atmosphere. The inlet port is then uncovered by the piston and there is a rush by the outside atmosphere to balance the pressure and so put the same volume inside the case as the piston has displaced on its way up the cylinder. This is where the Carburetter does its work.

You will see on the drawing several letters to describe the various parts. We will take these in rotation to describe their various duties :—

(A) This is a small gauze strainer placed in the petroil inlet to strain from the petroil any dirt or

foreign matter which you may have allowed to get into the tank through lack of care when filling up. Below this is

(B) which is the petrol valve which is pushed up to its seat as the float (C) rises against the platform (D) on which the end of the petrol valve rests.

When the petrol tap is turned on the float rises until the float chamber is filled to the proper level, whereupon the float lifts up the valve and cuts off the supply.

As the petroil is taken from the chamber through the Jet (E) the float allows the petrol valve to open and so keeps the level constant. This position is approximately three - eighths of an inch above the top of the jet when the engine is not running.

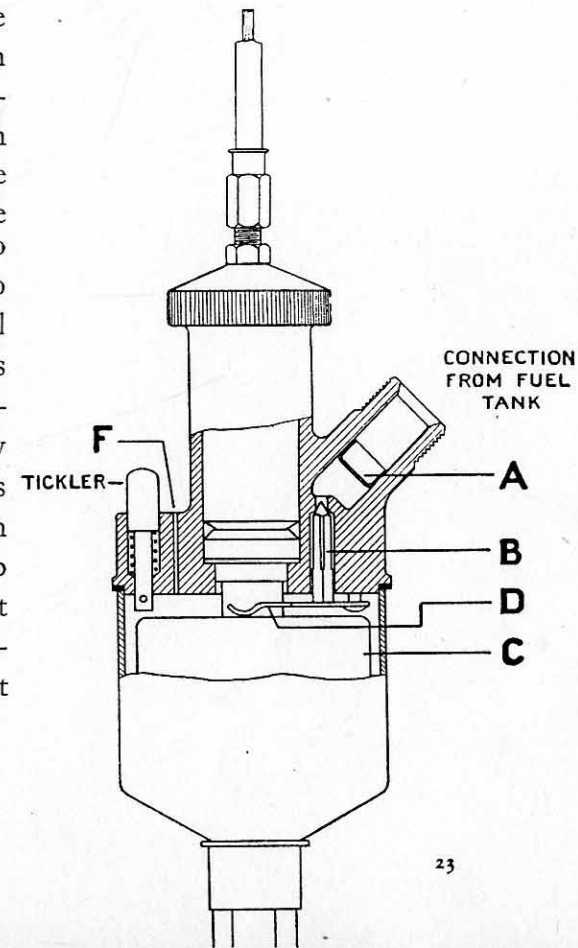


FIG. 3. (I)

There is also a small hole (F) which is drilled in the cover of the float chamber, and which keeps the air in the float chamber at atmospheric pressure.

You will see from the drawing that the jet is some distance from the centre tube which is called the atomizer tube and there is a hole (G) drilled through this tube a short distance from the bottom of the chamber which ensures the level of the petrol in the jet being the same as in the float chamber.

The end of the central tube is screwed and fitted with a nut and fibre washer to hold the float chamber in position.

Now let us turn to the atomizer. Just above the jet there is a very small chamber (H) into which are machined two holes. The one on the side (I) has a very small tube fixed in it which terminates in the main air intake (J). The other hole is machined through the centre of the tube also into the small chamber and opposite the jet.

Into this centre hole a taper needle (K), which is fixed in the throttle valve (L) slides. This throttle valve is opened and closed by the accelerator pedal, and as the valve which admits the main air is opened or closed, so the hole in the vaporiser allows more or less of the vaporised mixture to mix with the air, so keeping a proper mixture of petrol vapour and

air throughout the range of the throttle opening.

What happens is this (remember about the lower pressure in the crankcase):

When the inlet port in the cylinder is suddenly uncovered and the throttle valve is open, the air in the float chamber which is kept at atmospheric pressure by the air entering through the small hole above, forces the proper amount of petrol from the jet. It is then mixed with air from the small tube in the small chamber above the jet.

The mixture of the two at high speed vaporises the petrol. The vapour then goes up the central hole past the taper needle. This needle governs the amount of vapour necessary to mix with the air going past the throttle valve. It thus provides the perfect mixture necessary for the best expansion when eventually it reaches the cylinder (via the crankcase) and is ignited by the sparking plug.

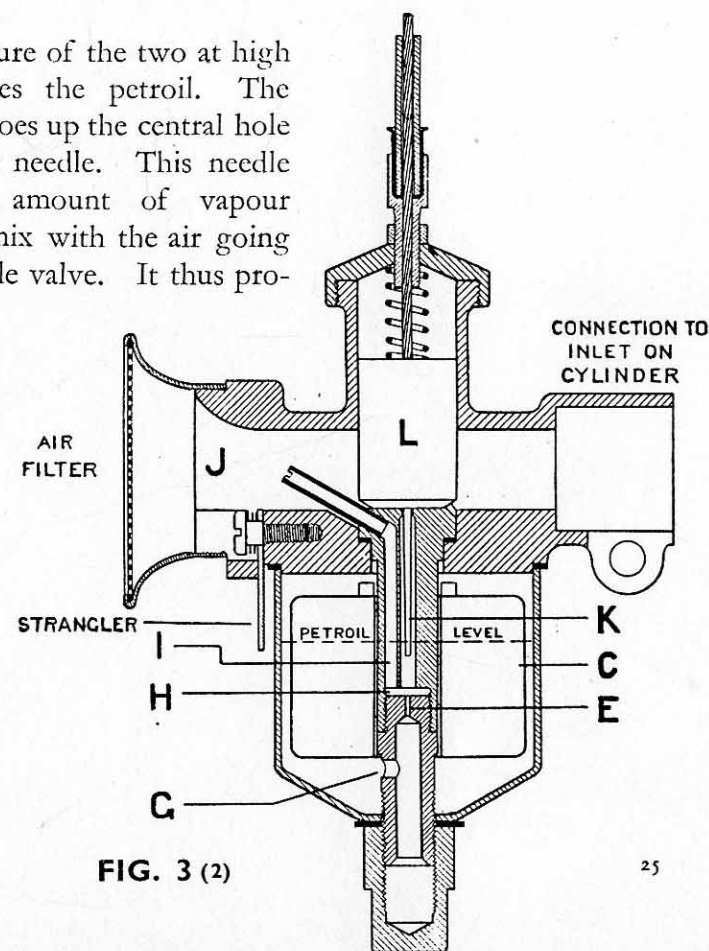


FIG. 3 (2)

SILENCER

The exhaust gases emerge from the cylinder outlet at a high temperature and considerably above atmospheric pressure. If they were immediately discharged into the air in this condition, the noise created would give everyone the impression that we were using a quick firing gun rather than an engine.

The exhaust is therefore led into the silencer, which is a cylindrical chamber of a much larger capacity than the engine cylinder, so that the gases can expand and cool without creating back pressure.

From here they discharge into the atmosphere through a "fish tail" outlet pipe which ensures the gas issuing in a wide flat stream, thus giving a final cooling effect.

TRANSMISSION

As you will have realised from the foregoing description of the engine and its details, a certain amount of work has to be done by it in driving its own ignition apparatus and also in acting as its own compressor and air pump. Although the energy required for these various operations is quite small in amount, it all has to come out of the power stroke, and, furthermore, not quite at the same period as the latter. The energy given

by the power stroke is, therefore, stored in the moving parts of the engine and a small portion given up as required for the pumping and ignition; the remainder being available for whatever purpose the engine is being used. This storing of energy is also of advantage as it smooths out the power impulses and prevents the main drive from being "jerky," but it means that our Internal Combustion Engine has to be kept running at a fair speed to give good results, and, although it may be accelerated up to very high speeds, it definitely must not be allowed to run too slowly or it will come to a stop.

Because it is a quick revolution engine, we cannot therefore couple it direct to the road wheels in a car, like we could do with a locomotive engine. It would be difficult to get away from a standing start, and in addition the resulting car speed would be too high. We have to resort to some sort of gearing between the engine and the road wheel in order to reduce the revolutions of the latter, and this portion of a motor vehicle is known as the *transmission*.

The principal device used for gearing together two parallel shafts which are not very far apart is the "spur gear." This consists of a wheel on each shaft with teeth cut across the rims; those on one wheel meshing with those on the other wheel thereby causing one shaft to be rotated by the rotation of the other. For parallel shafts further apart, chain transmission is very convenient.

This, in one of its lightest forms, you will, of course, easily recognise as being the main transmission of the push bike, and also used for the final drive to the rear wheel of the majority of motor bicycles. Both these forms of transmission are used on the Atco Trainer.

In larger vehicles we often find shafts to be coupled up which are at right angles to one another. In this case bevel wheels are generally used, which are simply toothed wheels with the teeth cut on a conical rim: there is also the worm gear which is a shaft with a kind of coarse screw thread cut on the end of it, this thread meshing into specially formed teeth cut in the rim of a wheel on the final shaft. The main difference to be noted between spur gear transmission and chain transmission is that, if we gear two shafts together by spur gears (one on each shaft), then the result gives us two shafts running in opposite directions to one another, but in a similar drive with chain transmission, both shafts would revolve in the same direction. In both types we can vary the shaft speeds in the same manner; for instance, if we have a driving gear of 20 teeth meshing with a driven gear of 40 teeth, then the driven shaft will only turn at half the number of revolutions of the driving shaft.

Reverse Gear.

It is necessary that we should, if required, be able to run a vehicle backwards, in order to increase the ease of handling in crowded areas, and also for general convenience.

Now, the internal combustion engine cannot be made to run in either direction without a lot of complicated mechanism, and therefore the reversing device is generally incorporated with the spur gears, as being the most suitable location. We saw, just now, that two shafts coupled by a pair of spur wheels, would revolve in opposite directions. If we throw these two gears out of mesh, and introduce a third gear wheel which will mesh with both of the original ones, then we shall now find that the two shafts will revolve in the same direction. In other words, the direction of rotation of the driven shaft has been reversed, and the third gear wheel which we have brought into action revolves in an opposite direction to the other two. Furthermore, it is easily seen that we can obtain an intermediate position, *after* the two original gears have been thrown out of mesh, but *before* the third gear wheel has been brought into action, when the engine will not be connected in any way to the road wheel. This is most important and should be taken careful note of. It is called the NEUTRAL POSITION of the gears and they must be in this position always when it is necessary to start the engine from rest by means of the starter lever. Neglect of this precaution would lead to trouble, as it is possible to start the engine even when it is coupled up to the road wheel, in which case the Trainer would run off quite unexpectedly and might do serious damage. This neutral position should also be used when it is desired to stop the Trainer for a time without stopping the engine.

The gear change lever is placed in the centre of the Trainer, convenient for the use of the driver's left hand, about half way between the seats and the pedals. The lever itself, you will notice, can be moved into any one of three slots along the top of its quadrant. The forward slot is marked "F," indicating that the correct gears are in mesh for forward motion, the rear slot is marked "R," indicating correct position of gears for reverse or backward direction, whilst the central slot is marked "N" which means that all gears are neutral and will not transmit the motion of the engine to the road wheels.

This brings us to another important item in the transmission line, namely *THE CLUTCH*.

As already pointed out, we must keep the engine revolving at a reasonable speed, and if under these conditions we were to attempt to mesh either of the sets of spur gears, the gear teeth would very likely suffer damage owing to the sudden shock, and even if they did not and were brought fully into engagement, the Trainer would start off in a very unpleasant manner, with the additional risk of stopping the engine or breaking a chain link.

This is where the use of the clutch becomes important. This component is mounted on a shaft just in front of the engine, and runs in ball bearings held on the engine unit side frames, being driven by a short length of chain from the engine sprocket. It is made up of two cast iron cones, which are carefully machined to fit one inside the other with a thin conical layer of friction fabric in between.

The outer cone runs free on the shaft and is the one which is driven by the chain from the engine. The inner cone is keyed to the shaft, but is free to slide endways for a short distance. The inner cone is pressed into the outer one by a spiral spring of such a strength that sufficient friction is set up between the two to transmit the maximum power of the engine without slipping.

If the pressure of this spring is momentarily relieved, the engine power is cut off from the clutch shaft, and the spur gears, the first of which is keyed to the outer end of this shaft, can be moved safely into mesh by means of the gear lever already mentioned.

Presuming, therefore, that we have started up our engine successfully, all we have to do is to engage either forward or reverse gear in order to travel in whichever direction we desire.

The clutch is released by pressing down the foot pedal on the left-hand of the steering column, and when the gears are in engagement, this pedal is allowed to come back gently so that the clutch gradually allows the power of the engine to be transferred to the gears and so finally to the road wheel, thus enabling the Trainer to start on its way quite smoothly and without shock to any of the working parts or to the occupants themselves.

At the same time that the left foot is letting the clutch gently in again, the right foot should be pressing down the accelerator pedal, which is the small curved

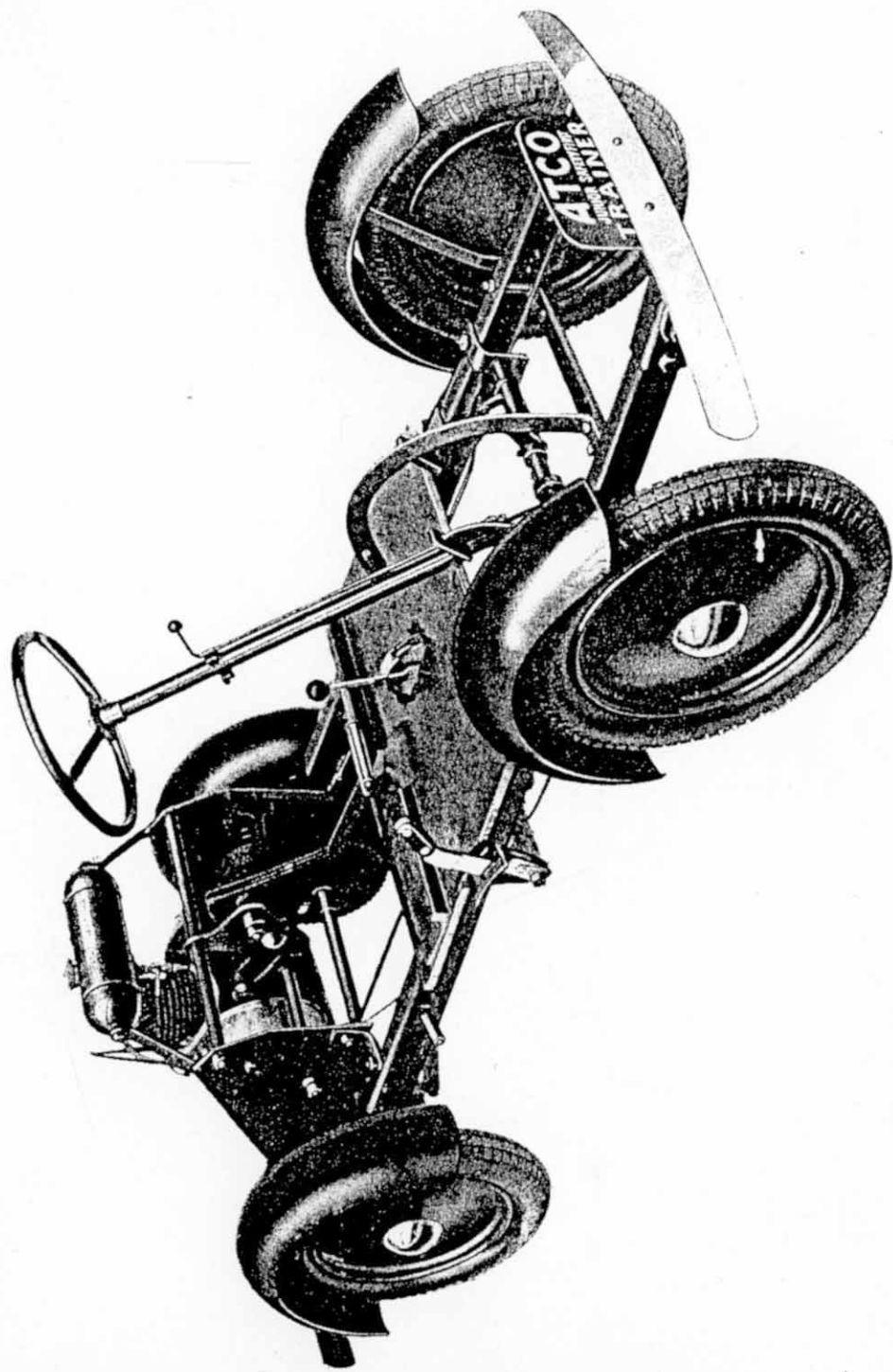
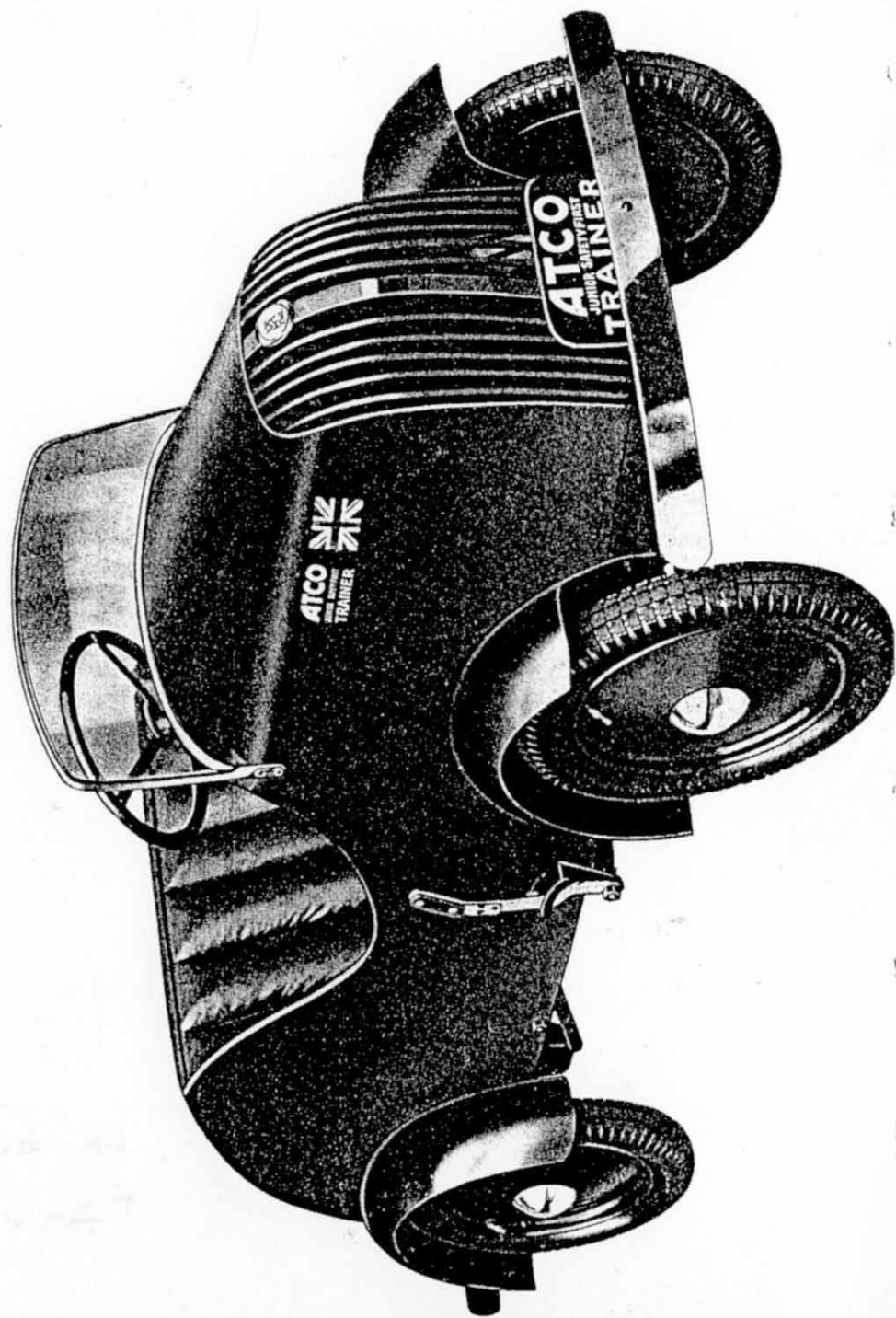
pedal immediately to the right of the steering column, which enables the engine to give out the increased power necessary to start the Trainer from rest. We will only touch upon this point here, however, as methods of driving and control are gone into more fully in other sections of this book.

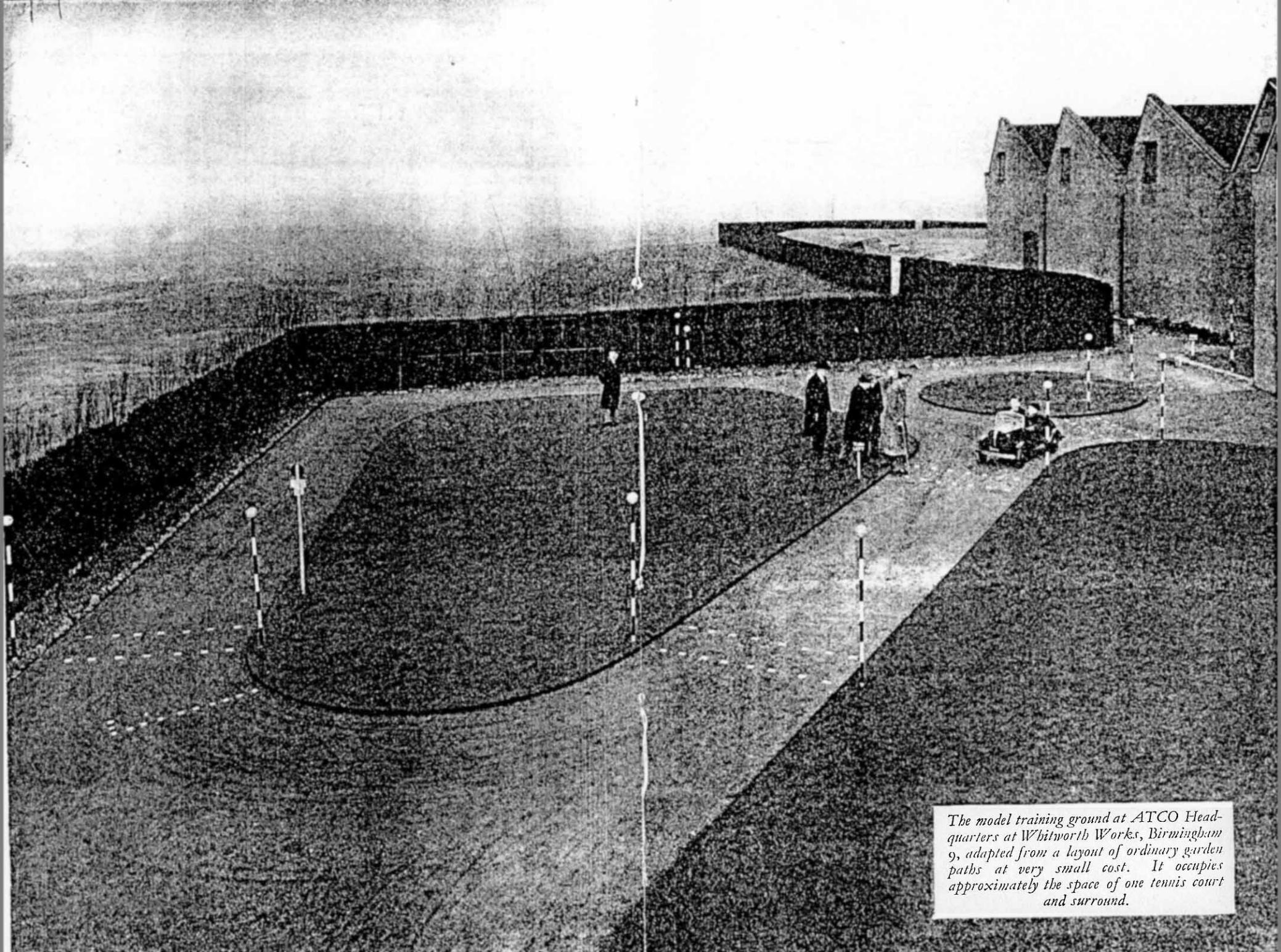
We have seen how we rely on "Friction" (in the clutch) for allowing the power from the engine to commence moving the Trainer in a smooth and easy manner, and this same Friction is used for bringing the Trainer to rest by means of the brake. In this case, by pressing a foot pedal, we bring a fabric lined steel strip into contact with a cast iron drum which is keyed to the rear axle, thus pulling the vehicle up in a distance which will depend on the amount of friction set up between the fabric and drum by the varying amount of pressure which we can put on the pedal. This is the pedal on the extreme right of the Trainer, and you will note that directly you remove your foot from it, the brake is released.

In order that the Trainer may be left with the brake on, a hand brake lever is fitted just outside the body and in a convenient position for the right hand. By this means, the brake can be left on sufficiently to hold the Trainer on a hill, if necessary, the hand lever or parking brake automatically locking itself in ratchet teeth cut in the quadrant of the lever support.

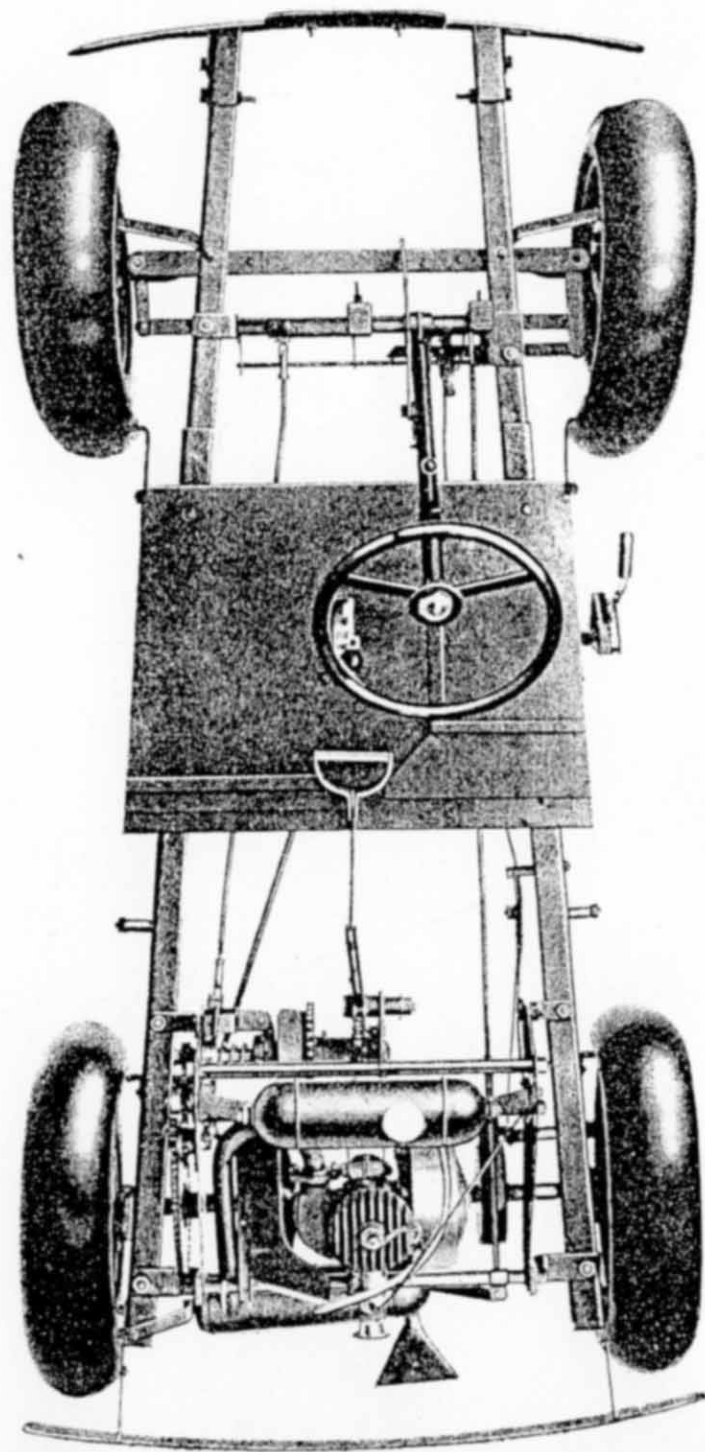
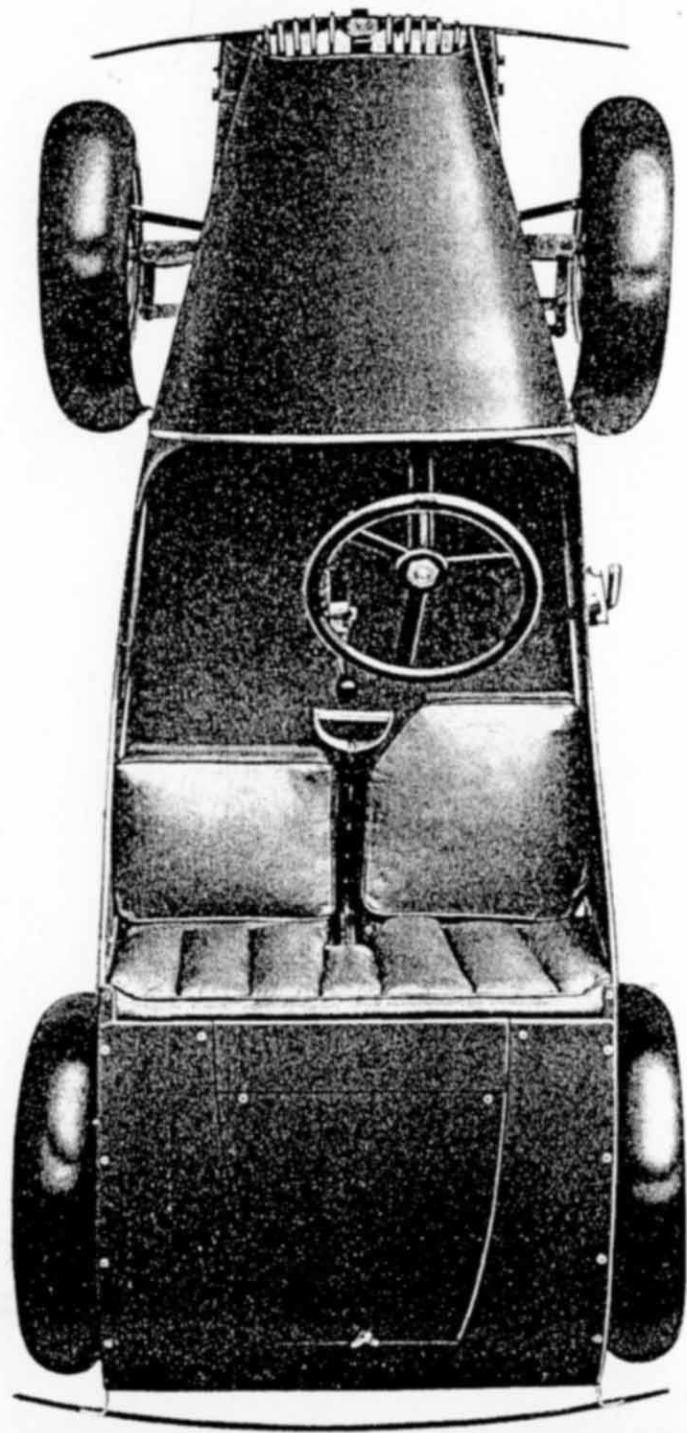
CLUTCH AND BRAKE PEDAL EXTENSION BLOCKS

We shall again mention the importance to the driver of being able to settle down in a comfortable position in the Trainer with all controls easily available for instant use when required, and with this end in view the steering column has been designed with a certain amount of adjustment in two directions. In addition, two extension blocks for the clutch and brake pedals are provided for the convenience of those who find any difficulty in reaching the pedals as supplied with the Trainer. It will be seen that these extensions are fitted with a spring pin, and if it is found necessary to use them, this pin should be withdrawn, and the guides at the back of the block pushed down over the sides of the pedals. Care must be taken to start with the end which is drilled for the pin, as the top end is slightly closed-in to prevent the fitment sliding down too far. After the block has been pressed down on the pedal pad as far as it will go, the pin holes will appear below the lower edge of the pad and the spring pin should then be re-inserted in order to prevent the extension being jolted upwards and off the pedal by the action of the foot.





The model training ground at ATCO Headquarters at Whitworth Works, Birmingham 9, adapted from a layout of ordinary garden paths at very small cost. It occupies approximately the space of one tennis court and surround.



STEERING

The steering of motor vehicles is of the Ackermann type, and a few notes on this will be of interest.

If you notice the front end of a four-wheeled horse-drawn van, you will see that the front axle and wheels are carried by the springs, on a sort of turntable frame, which is pivoted in the centre, and when taking a sharp bend this frame swings round on its pivot until the front wheels are nearly on the centre of the van which is built high enough to allow for this.

We could not, however, use this method in a motor car, as the frame and bonnet would have to be made so narrow at the front end as to be useless ; or, alternatively, the diameter of the front wheels would have to be absurdly small so that they would swing round under the frame on sharp corners.

The Ackermann steering consists of a front axle which is attached to the main frame and does not move. Both ends of this main axle carry vertical pins on each of which a short axle, known as the swivel axle, is free to turn, under control of the driver, by means of the steering wheel.

The swivel axles each carry a front wheel, and they are coupled together by a link across the Trainer known as the track rod, which joins the steering arms together. These

steering arms are rigidly fixed to the swivel axles and point towards the rear of the Trainer, so that the track rod is parallel to the front axle but some little distance behind it.

Now, one of the main features of good steering is that the centre lines of *both* front hubs, when in a position for taking a bend of any radius, should, when produced, both cut the centre line of the rear axle (also produced) at *one and the same point* ; this point being the centre of the circle in which the Trainer will turn on that particular steering lock.

If these centre lines cut the centre line of the rear axle at two different points, then we are faced with the difficulty that each wheel is trying to bring the Trainer round in a circle of its own particular radius, with the result that either one or both of them will skid slightly with consequent rapid wear of the tyres.

The front axle of the horse-drawn van is perfect in this respect, as both front hubs and front axle are always in the same straight line, through whatever angle the turntable is moved.

In the Ackermann steering, however, to get the desired result, the front wheel on the inside of the curve has to be turned through a greater angle than the outer wheel. Now, how are we to do this with one motion of the steering wheel, and when taking either right or left hand bends ?

The solution to the problem is quite simple. The steering arms which were previously mentioned as fixed

rigidly to the swivel axles are placed at rather more than a right angle to the latter, so that although they stand back towards the rear of the Trainer, they also incline somewhat towards each other, and would in fact meet if they were made long enough, on the centre line of the Trainer near the rear axle.

This means that the coupling or track rod is shorter than the distance between the vertical swivel axle pins, and if this variation is correctly proportioned we get, to all intents and purposes, good steering at any lock, both on left or right hand turns, the effect of this inclination of the steering arms being such that, in whatever direction the steering wheel is turned in order to take either a right or left hand corner, the front wheel on the inside of the curve gets locked over at a bigger angle than the outer one.

On larger vehicles, due to the heavy weight to be controlled, the steering wheel is geared to the operating mechanism by means of worm or screw gear, necessitating a considerable movement of the wheel to obtain the desired steering lock. This, of course, reaches its maximum in very heavy passenger and goods vehicles.

On the Atco Trainer, which is designed for extreme lightness and with as little complication as possible, the wheel is coupled direct to the steering arms by means of a link, and it will be found that quite a small movement is necessary to operate the gear.

(3) HOW TO ACQUIRE SECOND-NATURE CONTROL.

Practise, practise and more practise on an easy, safe garden circuit or open space, until you can say truthfully that so far as control is concerned, you can "Do it with your eyes shut." "Do it standing on your head." "Do it without thinking of what you have to do," or any other expression that means you can do it all *instinctively, automatically*.

Then compel yourself to practise all over again.

Do not bother at all about thoughts of traffic or awkward turns, road rules, Belisha crossings and beacons, collisions, or anything other than acquiring the "feel" of your Trainer. When you feel sure that you have the "feel" of it—then decide to have say 6 more half-hours on your own on different days, getting your "instinctive" control firmly established for ever.

When you start learning to swim, it seems almost impossible to work all the movements into a graceful rhythmic stroke, but once you've mastered it, it seems easy and you have it for life. The same applies to controlling your Trainer, only the functions are really more complicated.

If you will only remember that this is the first vital and most important part of your training, we believe you will stick at it until you have really mastered it, not just until the first occasion on which you THINK you've mastered it.

Having mastered it, you have mastered the essential principles of the control of most vehicles you are likely to have to deal with later on, including cars, lorries, tractors, buses, mechanised army vehicles, etc.

Now, here are some hints for learning

AUTOMATIC CONTROL

(1) Select an open space or plain circuit where you can be undisturbed.

(2) Wheel the Trainer into position and practise getting in and out of it, and making yourself comfortable at the wheel.

(3) Get used to the foot controls—clutch (L.H.), accelerator (central), footbrake (R.H.).

(4) Get used to the feel of the hand-parking brake (R.H.) and the gear lever (L.H.), also the hand-controlled throttle on the steering column.

(5) Practise finding the gear lever knob until your left hand leaves the steering wheel and automatically finds it. Do the same with the right hand and hand-parking brake-lever.

(6) Practise putting the clutch pedal fully out and with it there, putting the gear lever into Forward gear and then Reverse gear.

Do all this over and over again until you feel thoroughly comfortable.

NOW START UP THE ENGINE, AS DESCRIBED IN DETAIL ON PAGE 52

TRAINING UNDER POWER.

(7) Get in, and after settling comfortably into the driving position, open and close the hand throttle until you find a nice tick-over setting. If you stop the engine once or twice doing this or later in letting in the clutch, it is all good practice.

(8) Depress the clutch pedal and, while holding the clutch pedal depressed, put gear in forward position. Release the hand brake.

Having got the forward gear in, you can now gradually release the clutch pedal, depressing the accelerator a little as the clutch takes up the engine power and starts to drive the wheels.

(9) You will “stall” the engine once or twice while trying this out, but that is good practice. If you do, put gear lever in neutral and go through the sequence of operations again.

(10) Well, you are now moving forward under power and have nothing to do but steer on your flat open space or easy course. Do this for some minutes, feeling the power of the engine by depressing the accelerator pedal every now and then. Apply the footbrake lightly every now and then to get the “feel” of it.

(11) Next, depress the clutch pedal and the Trainer will come to a stop ; more quickly, of course, if you put the footbrake on. Move gear lever into neutral, let clutch pedal out, put hand-parking brake on, and finally stop the engine by closing the hand-throttle.

(12) Do the whole business all over again, but this time, after going forward awhile, stop the Trainer as before, but not the engine.

Depress clutch again and put gear lever into reverse ; let in clutch gently as for forward gear and go a few yards backwards.

(13) Go on with this practice painstakingly, making more and more stops and starts, using the accelerator more freely.

THEN, when you begin to feel a bit confident, ask someone to come round the course in the passenger's seat. You'll probably make some mistakes then, and that is all to the good, because it will prevent over-confidence and make you want to practise seriously all the more thoroughly.

(14) Now you can begin to practise drawing up at an exact point which you have decided before, and you can also do more reversing. Try putting the footbrake on in various degrees of severity and try sharp acceleration, letting the clutch in on a turn, turning the Trainer in figure 8's and so forth, with stops and starts here, there and everywhere.

(15) Presently, and much quicker than you think at first, you will have complete automatic control of the Trainer, so that when you are at the wheel, it is, as it were, part of you, almost as obedient and docile as your own limbs.

YOU WILL THEN HAVE ACQUIRED "SECOND-NATURE CONTROL" AND ARE IN THE HAPPY POSITION TO APPROACH ALL FUTURE DRIVING PROBLEMS WITHOUT GIVING A THOUGHT TO THE QUESTION—

"CAN I MANAGE THE CAR ITSELF?"

(4) HOW TO LEARN TO DRIVE IN ACCORDANCE WITH MODERN ROAD RULES.

(1) Read the copy of the Highway Code supplied with this book.

(2) Ask an experienced driver to explain the *meaning* of and *reason for* any item in the Code which you do not fully understand.

(3) When being driven in a private car, bus, tram, lorry, or when walking or riding, observe the methods of the driver, and of other drivers, walkers and riders, and see how they put the rules and recommendations into practice. Be critical in your own mind of the way they are conforming to the rules. While you cannot often interfere and put people right, you can learn for yourself and you can describe the mistakes of road users whenever opportunity occurs in conversation.

(4) Coming to the use of your Trainer, in accordance with Road Rules you should *always* observe the Highway Code in your driving, once you have mastered "Second-Nature Control"; except when you want to do some "record" driving, in which case you should make sure you are going to "race" on a "closed circuit."

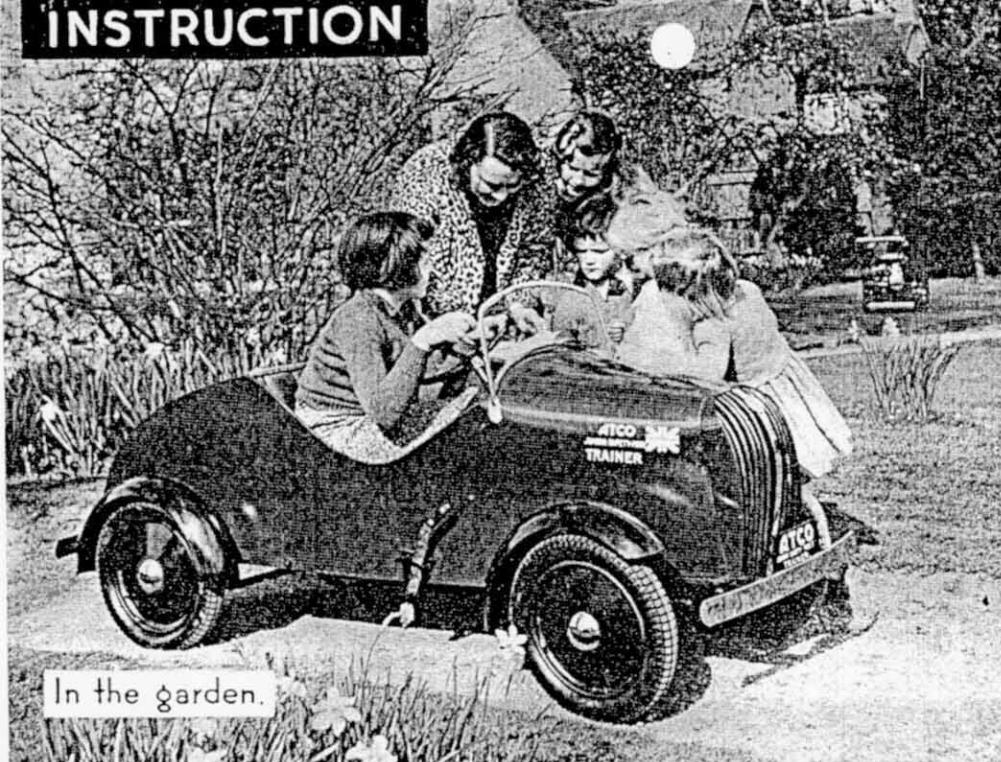
For all great motor races and track work, the circuit is closed and the drivers need have no concern for traffic other than other drivers legitimately on the course.

(5) The Highway Code and road rules generally will be altered or added to as time goes on. Helped by your Trainer and the above suggestions, you will have a thorough knowledge of the current rules. This note is to suggest that you keep abreast of all modified or altered rules and keep particulars of them in this book.

(6) It will help you a great deal and add to the interest if you can fit up some of the regular road signs, which can be home made. Some white lines, studs, sign posts, beacons, etc., etc., are not difficult to manage and a quite small selected circuit can be made a most entertaining and instructive Driver-Test-Ground in this way. And bicycles, pedestrians, dogs, pedal cars, wheelbarrows, and so forth, can be got together quite frequently.

For, above all, the Atco Junior Safetyfirst Trainer is a safe miniature in itself and in use its speed is, like nearly everything else about it, scaled down to the needs of training on a model, in model surroundings.

In other words, its general performance is in keeping with its size and purpose.



In the garden.



II MAINTENANCE

1. INTRODUCTION.

Once again, as in the introduction to the "TRAINING" Section of this book, we stress the importance of studying this Manual, and keeping it in its partition in the Tool Box.

By using it at the outset, at times with the close interest of a grown-up who should also work from it, you will START RIGHT and by occasional reference to it you will GO ON RIGHT.

Don't make the mistake so often made of disregarding it because it is "given away with the car." It is a valuable book and an essential part of the cost of your Trainer.

Preserve it as such.

(2.) RUNNING INSTRUCTIONS, ADJUSTMENTS, LUBRICATION AND CLEANING

RUNNING INSTRUCTIONS.

STARTING FROM COLD.

- (1) See that the tank contains Petroil mixture.
- (2) *Make sure* that the Gear Lever is in neutral position, which is the centre slot in the Gear Quadrant marked "N", and the hand brake pulled on.
- (3) Turn on the Petroil Tap, and press down the small knob on the carburetter called the tickler until petroil emerges from the small air hole on top of the float chamber.
- (4) Close the Air Strangler or Choke.
- (5) Open the hand Throttle Lever on the steering column about half way.
- (6) Lift up the Starting Lever until the quadrant engages in the free wheel; then give a sharp pull up, and, if necessary, repeat several times. When the engine has started, open the choke and adjust the hand-control lever until the engine runs slowly.
- (7) *Important* : When starting with the engine warm, don't flood the carburetter or use the choke.

The Trainer is now ready for moving off.

Firstly, get comfortably seated; then press out the clutch pedal, which is the one on the left of the steering column; then put gear lever into the forward slot in

quadrant marked "F." If the gear lever will not "go home," put it back into the Neutral position, let the clutch back momentarily and then repeat the process. If you are on a flat road, release the hand brake, then let the clutch pedal come back very slowly, controlled by your left foot. At the same time as the clutch begins to make contact, press down the curved accelerator lever just as carefully with your right foot as you are releasing the clutch pedal with your left foot. It will need some practice to master this properly, but when mastered, you should be able to move away with any car, smoothly and without unduly racing the engine.

When the Trainer is moving, it is *very important* that you take your foot off the clutch pedal and control the Trainer entirely with the right foot on the accelerator pedal.

It is best first to learn to start the Trainer on a flat road, and when you are proficient in this you may practise starting up on an incline. To practise this, go through the same movements as before, but don't remove the hand brake. When your feet are in position on the clutch and accelerator pedals, take hold of the hand brake lever and start to operate the clutch and accelerator as before. When you feel that the clutch is gripping sufficiently, slowly let off the hand brake as the Trainer moves forward. This is very important, and you should practise this until you can get away smoothly *without the Trainer moving backwards at all*.

To stop the Trainer.

Press out the clutch and brake pedals. The Trainer will then stop. While holding out the clutch and brake pedals, put the gear lever into the central slot marked "N" for neutral, and pull on hand brake. Then release both foot controls.

Stop engine with the hand control.

When putting the Trainer away, it is advisable to stop the engine by turning off the petrol tap. By doing this, you are partially emptying the float chamber, and when starting up again fresh petrol is taken from the tank which ensures easy starting.

Should starting difficulty be experienced, it will be most likely due to one cause, for which the remedy is simple. The engine may have been turned over a number of times without starting; or in other ways, such as excessive flooding, etc., petrol may have accumulated in the crankcase. If this has happened, open the throttle lever on the steering column wide: also make sure the choke or Air Strangler is fully open. Then use the starter several times. If the engine still fails to start, it is probable that the sparking plug may have become drenched with oil, or sooted up, and will therefore not spark.

Remedy:

Remove the small drain plug which is screwed into the crank case below the driving chain, and allow all petrol to drain out: also remove the sparking plug.

After the petrol has drained from the crankcase, turn the engine over sharply several times with the starting lever. This will blow out any other excess petrol from the crankcase. Then replace the crankcase plug.

Thoroughly clean the sparking plug. This plug is of a specially selected type, which has been found most suitable for this engine. To do this proceed as follows:—

Place the plug in the permanent spanner provided on the machine. Then, with the plug spanner provided in the tool kit, unscrew the inner portion from the outer. The central electrode can then be withdrawn. Take care not to lose the small copper joint washer which ensures the plug being gas tight when assembled. Clean the central electrode carefully and thoroughly, and scrape out the body of the plug. Then, be quite sure you put the copper joint washer in its place. Afterwards, re-assemble the plug.

If the plug is assembled without the joint washer, permanent damage may be done to the fine platinum point. Check the width of the gap after assembly: this should be .02 inches, which is approximately the thickness of a visiting card.

Periodically, it is advisable to go through the procedure of draining the crankcase and cleaning the plug.

ADJUSTMENTS.

CLUTCH.

When the clutch is properly adjusted, there should be 1 inch of free movement on the clutch pedal before it

starts to release the clutch. To adjust this, remove the seats and footboard; take out the small split cotter from the joint pin which connects the fork end of the rod to the pedal; slacken the lock nuts and withdraw the joint pin. Turn the fork end until the required position is reached. Then replace the joint pin and split cotter and fasten up the lock nut.

CHAINS.

These should seldom require adjustment, but, if necessary, proceed as follows:—

Slacken off the nut at the end of each of the two lower main tie rods.

To adjust engine chain, draw the engine back until the slack is taken up.

To adjust the chain from the gear to rear axle, lift up the back tie rod and tighten up the nuts.

After doing this, make sure the chains are not too tight. The free portions of both chains should have approximately $\frac{1}{2}$ inch of up-and-down movement when properly adjusted.

STEERING.

The position of the steering wheel is adjustable both for angle and height, in the following manner:—

There is a stay from the front axle which is fixed to the steering column by a bolt and nut. To alter position of wheel, slacken off this bolt. Then move the wheel to the position required.

To adjust for height, slacken off the square head set pin in the plated collar immediately under the steering wheel. The wheel can then be moved up or down. The range of this adjustment is rather limited.

Don't turn the plated collar round from its position when the screw is slacked off.

BRAKE.

This should rarely need adjustment. If this should be necessary, you will find that the rear end of the brake rod is screwed, and fitted with two nuts between which the brake band is held. Slacken off these nuts and adjust until the brake pedal has 1 inch of free movement before the brake band engages the drum.

Both hand and foot brakes are adjusted by this one operation.

TYRES

The Pneumatic tyre as fitted to modern motor vehicles consists of two main portions, the inner tube and the outer cover.

The former is a continuous circular tube of flexible rubber which forms an airtight container. It is fitted with a valve through which air can be pumped to a pressure suitable for the size and weight to be carried. No portion of this tube comes into direct contact with the ground.

The outer cover, as its name implies, is a casing inside which the air tube is placed. It has an outside surface of

rubber (thickened up on the outer diameter or tread which comes into contact with the road), vulcanized on to an inner casing of strong cord, the whole construction combining the requisite amount of strength without, however, introducing too much weight.

The rubber used for this casing is a mixture of pure rubber and various substances which have been found by long experience to give toughness and maximum resistance to wear due to contact with the road surface.

When all this is in position on the wheel, air is pumped into the inner tube, which immediately expands inside the outer cover, causing the latter to retain its position firmly on the wheel rim. At the same time the cushioning effect of the air in the tube damps out the roughness and smaller inequalities of the road surface in a very effective manner.

Now, this elasticity of the air in the inner tube causes both the tube itself and the outer cover to flatten out slightly where the weight of the car comes into force, namely, the place of contact of the wheel with the road, so that you can easily realize that when the car is in motion and the wheel turning, every portion of the tyre circumference in turn undergoes this flattening process as it feels the weight of the car.

Under ordinary conditions, the side walls of the outer cover are perfectly capable of dealing with this constant deflection due to change of shape. If, on the other hand, the pressure of air in the tube is allowed to fall so low that this flattening out process becomes magnified, the side

walls of the outer cover will undergo such a severe amount of bending that they will eventually develop cracks and become dangerously weak. From this it will be apparent how necessary it is to keep up the pressure of air in the inner tube, and, in fact, so much importance is attached to this point by tyre manufacturers, that in the case of the larger type tyres fitted to full-size cars, pressure gauges are made which can be applied to the tyre valve for frequently checking the air pressure.

On the lighter tyres, as fitted to the Atco Trainer, however, it will be sufficient if the tyre is tried by pressure of the fingers, to ascertain if it still offers a firm resistance and has not become flabby; also, the point of contact with the ground should be noticed in order to see that the shape at this point does not differ in a great degree from that of the rest of the tyre.

It is also important periodically to examine the outer surface of the tyre tread, in order to find whether the rubber has been cut by small flints or other means during running. Such cuts, when found, should be carefully cleaned out and filled with one of the tyre cements readily obtainable, as if left without attention moisture will work through and eventually rot the cord base of the cover, causing a weak spot.

Any small chippings, found embedded in the rubber, should also be removed, and the space left filled in with tyre cement.

When driving always be careful, if running close in to the edge of the road in order to pull up or for any other reason, not to let the tyre rub the kerb, as this puts a severe strain on the side walls of the cover. It is also inadvisable to drive up over a sharp edged kerb stone. Always try to fix up some kind of a ramp or sloping board if it is necessary to cross over a kerb or other sharp-cornered raised obstruction.

LUBRICATION.

Engine.

This is lubricated automatically if the proper quality of petrol and oil are mixed in the right proportions and well shaken up in the petrol tin.

The mixture is called Petroil.

5% The correct proportion of oil and petrol for use with the Trainer is— $\frac{3}{4}$ pint of oil, which should be put into a 2 gallon tin of No. 1 petrol and thoroughly mixed by shaking the tin after the stopper has been replaced.

It is also advisable to shake the tin at all times before replenishing the petrol tank, and always to use a strainer when doing so.

There are a number of parts about the machine which require lubricating :—

- (1) The two driving chains require a few spots of oil occasionally.
- (2) The Clutch and Clutch shaft which are fitted with three lubricators—one on each bearing and one in the centre bearing of the Clutch itself. The one on the clutch can be brought into

position for oiling by using the starting lever to turn the clutch slowly until the lubricator comes on top.

- (3) The Clutch, Foot Brake and Accelerator Lever bearings all work on one shaft, and a few spots of oil should be applied occasionally in the holes in each bearing.
- (4) All the Joints of the Steering Gear, particularly in the lubricators of the swivel pins.
- (5) The front wheels are fitted with roller bearings which are packed with grease, but a hole for lubrication is provided on each, and a few drops of oil should be applied occasionally.

The near side rear wheel which is free on the Axle, is fitted with an oil-impregnated bush, but it is also fitted with a hole for lubrication, and a few drops of oil should be applied occasionally.

- (6) The Rear Axle is fitted with ball bearings which are packed with grease, but there is a hole drilled in each housing into which a few spots of oil should be applied occasionally.
- (7) It is also advisable to put a small quantity of grease on the teeth of the gear wheels and a few spots of oil on the open ends of the Bowden Cable and the Joint pins of the Clutch and Brake operating mechanism.

CLEANING.

In addition to oiling and making necessary adjustments to the Trainer, do not forget its outward appearance. Care should be taken against it being knocked about or scratched. It should also be cleaned regularly with a good supply of cold water and a sponge, after which it should be dried off with a chamois leather.

(3) TOOL KIT

The special sliding box contains, in addition to this Manual, the following contents:—

One double-ended spanner $\frac{1}{8}$ in. and $\frac{3}{16}$ in.

One double-ended spanner $\frac{1}{4}$ in. and $\frac{5}{16}$ in.

One double-ended spanner $\frac{3}{8}$ in. and $\frac{7}{16}$ in.

Plate spanner.

Magneto spanner.

Oil can.

(4) ATCO SERVICE

Care of your Atco Junior Safetyfirst Trainer, in accordance with the Instructions given in this Manual, will keep upkeep costs down to a minimum.

In fact, wear and tear will be greater or lesser in direct relation to the amount of work the Trainer is put to and the amount of Instruction-Manual-attention it receives.

Being made throughout of the finest materials and by first-class men, it will last indefinitely, subject to proper attention and periodical service.

To supplement your own attention in regular lubrication, adjustment, etc., and that of local dealers, there exist 10 specialised Atco Service Depots, full addresses and 'Phone Nos. of which are given below. These Depots are manned with staffs fully qualified to give advice free of charge in connection with your Atco Junior Safetyfirst Trainer, and to carry out any service work or overhauls entrusted to them, efficiently and at reasonable prices.

The Manager of any Atco Depot would welcome a visit from you at any time, but preferably with a day or two's notice, and would be able to make such a visit really interesting and helpful.

If you wire or 'phone the nearest Atco Depot you will get enthusiastic attention; and even in the event of it not being the Depot dealing with the area in which

you keep your Trainer, the Staff would take a note of your wishes and immediately get the correct Depot to communicate with you.

So—whenever you want our advice or service, the Atco Depots are “AT YOUR SERVICE.”

Atco Depot, Progress Way, Purley Way, Croydon, Surrey. 'Phone: Croydon 3471.

Atco Depot, Hills Road, Cambridge. 'Phone: Cambridge 87462.

Atco Depot, Whitworth Works, Birmingham, 9. 'Phone: Birmingham, Victoria 2524.

Atco Depot, 410, Chepstow Road, Newport, Mon. 'Phone: Newport, Mon. 3470.

Atco Depot, County Road, Ormskirk, Lancs. 'Phone: Ormskirk 239.

Atco Depot, Rotherham Road, Eckington, Sheffield. 'Phone: Eckington 73.

Atco Depot, 396, North Road, Darlington. 'Phone: Darlington 2671.

Atco Depot, Alphington, Exeter. 'Phone: Exeter 3882.

Atco Depot, 106, Bath Road, Calcot, Reading. 'Phone: Reading 3443.

Atco Depot, Kilmarnock Road, Newton Mearns, by Glasgow. 'Phone: Newton Mearns 2502.

Also at Belfast and Dublin.

(5) GENERAL

This brings us to the end of our journey in preparing the first Manual of Junior road-vehicle training ever published, and if it falls short in certain respects we ask your indulgence, because it is the FIRST of its kind.

Will you *please* write to us any useful suggestions, ideas, queries, etc., about the Manual, or the training scheme in general, to—

CHARLES H. PUGH, LIMITED,
ATCO JUNIOR SAFETYFIRST TRAINER DEPARTMENT,
WHITWORTH WORKS,
BIRMINGHAM, 9.

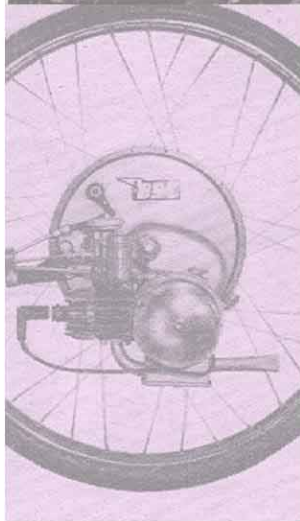
Established over 80 years in the
Engineering Industry of England.

NOTES

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