AERO MODELLER

Engine Special 1940's

"MY ENGINE"

(IN ITS FINAL FORM)*

BY LAWRENCE · H · SPAREY

SOME readers may remember that some time ago details were published in this paper of a preliminary design for a 6 c.c. aero engine. Since that time I have had opportunity to reconsider my rough draft, and to "clean up," as I promised to do, many of the unusual features. As the publication of my proposals seems to have aroused interest, readers may like to see the design that I have finally settled upon.

A glance at the illustration in Fig. 1 will show that the main features remain essentially the same. These include twin plugs, rotary inlet valve, cast-iron bearings and an underfitting anchorage for the gudgeon pin. However, the drawing shows that the bearings for the main shaft and auxiliary shaft are now each in two portions. This was done because the parts will now be easier to make, and because the small gap between the two portions of the bearings will provide an oil reservoir, which may be fed from the oilways in the casting. The drawing still shows that two piston rings are fitted to an alloy piston, but as I stated before, I have a slight preference for a cast-iron piston lapped to a fit within the bore, and the engine will incorporate that arrangement.

So much for the main features. Most alterations, however, have been made to the arrangement of the contact breaker, both in its design and position on the engine, and in the arrangement of the carburetter. In the first place, the whole of the contact breaker mechanism has been transferred from its position behind the propeller boss to the auxiliary shaft of the rotary valve. My reason for not placing it in this most obvious position in the first instance was because of the presence of the carburetter; the rear face of the crankcase is only 1¼ in. in diameter, and as the opening for the rotary valve is only 13/32 in. from the centre line, I could not see, at first, just how the two components could function in so cramped a space, or even how they were to be got in. But more of this later.

The push rod system of operation has been abandoned, and in its place has been substituted a long rocker arm, which pivots in a small fork on the contact breaker casting. This is much neater in appearance than the push rod system, is lighter, and should be more reliable in operation. At the same time, my object in keeping the points well away from the oil which inevitably finds its way out of the bearing ends has been maintained.

While the drawing in Fig. 1 shows the arrangement quite well, I feel that the little free-hand sketch in Fig. 2 will make the matter clearer for most readers, besides affording some amusement for Mr. Rupert Moore and, possibly, Freddie. Disregarding the artistic merits of the sketch, readers will see something of the actual shape of the contact breaker casting, and it will be noted that the fork in which the rocker pivots is integral with the casting, which is held to the rear bearing-housing by means of a split collar and bolt. Contact of the lower part of the rocker arm upon the cam is maintained by a stiff spring (marked x), while the rocker arm itself passes through a hole in the long ignition lever. Taking it all round, I think that the arrangement provides everything that we may look for in a contact breaker.

The placing of the breaker at the rear of the engine necessitated a complete re-designing of the carburetter, and in toying with various ideas it was early impressed upon me that the main body of the carburetter would have to form part of the casting of the crankcase-rear-cover. (I trust that readers will forgive the use of these long, compound terms, which savour too muoh of the German language!)

Accordingly, this was done, and the carburetter body was made to occupy the position along the side of the auxiliary shaft-housing. The drawing (Fig. 1) cannot, therefore, show the carburetter, as this drawing depicts a vertical cross-section of the engine through its centre line. Components which lie outside this plane must be shown in separate detail, so I have prepared a series of drawings, traced off my original detail drawing, giving the necessary particulars.

Before referring to these, we may again glance at my sketch in Fig. 2, which shows how the carburetter casting and the shaft-housing are integral with the rear cover of the crankcase. This sketch does, in fact, depict the manner in which the carburetter and petrol tank are attached to the engine, while Fig. 3 gives details of the casting. This is a plan view of the component, viewed as if looking from the top of the engine. Fig. 4 is the end view of the casting, where it will be noted that the carburetter portion has two circular lugs on the top and bottom. The matter is amplified by the drawing (Fig. 5) of a section taken on a line (A), (A). Here, it will be seen that the hole for the inlet valve in the crankcase back has been continued to form a venturi-shaped opening for the air intake of the carburetter, while a vertical hole provides a housing for the body of the carburetter itself.

This brings us to the actual carburetter assembly as shown in Fig. 6. The portion marked (1) is, of course, the section of the main housing shown in Fig. 5. In this drawing (Fig. 6) is shown, however, the body of the carburetter held in the housing. The body is marked (4). It consists of a plain, cylindrical turning, with a small collar turned near one end. The arrow leading from the figure (4) is actually pointing to this collar. The top part of the body is threaded for a short distance, while the remainder is made a push fit in the housing. The body is also drilled along its length, and the top portion of this hole threaded to take the adjusting needle. Into the lower bore is pushed a small length of brass tubing, into the top of which is soldered the jet. This tubing is marked (6).

The lower end of the carburetter body is sweated into the petrol tank, and the whole is retained in the housing by means of the nut, marked (3). On inspection, it will be appreciated that this provides a very simple means of reversing the carburetter and tank. All that is required to remove the needle (2), unscrew the nut (3), withdraw the body of the carburetter (4), (together with the petrol tank), and push the body back into the housing (1), but this time from the opposite side. On replacing the needle valve and the nut (3), the whole carburetter assembly assumes a reverse position in the housing, and

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* This article of Mr. Sparey's was written prior to that of Dr. Forster's (November "Aero Modeller"), in which the latter offered criticisms and comments. A further article from Mr. Sparey will appear in the February issue, in which he will reply to Dr. Forster. Much useful data will undoubtedly come to light when two such experienced "petroleers" get together!

the engine may then be run inverted. In the construction it will, of course, be provided that the hole which runs through the body will exactly register with the venturi-shaped hole in (1), in either upright or reversed position.

When the engine is mounted in the 'plane in an inverted position, the long ignition lever will, of course, protrude from the bottom of the 'plane, if assembled as shown in Fig. 1. To avoid this awkward position, the timing cam on the auxiliary shaft will be set in such a manner as to allow the ignition lever to protrude sideways, instead of vertically. This means that it may protrude from the side of the aeroplane through a small slot in the engine cowling, in a very convenient manner. On reversing the engine, no alteration need thus be made in the contact breaker, as the only result of turning the engine upside-down will be that the lever will protrude from the opposite side of the cowling.

From the above brief notes it is hoped that some idea may be had of the lines upon which the preliminary design has been modified. The engine does, in fact, contain other unusual features which I cannot disclose at the moment. An experimental model has already been constructed, and its performance and general convenience have been very good, so much so, in fact, that arrangements have been made for the engine, in a commercial form, to be produced and marketed by a well-known firm after the war. In conclusion, I should like to make acknowledgments to Mr. Edgar T. Westbury, the well-known designer of model petrol engines, whose published experiments have been a constant source of inspiration over a number of years.

FIG. 1

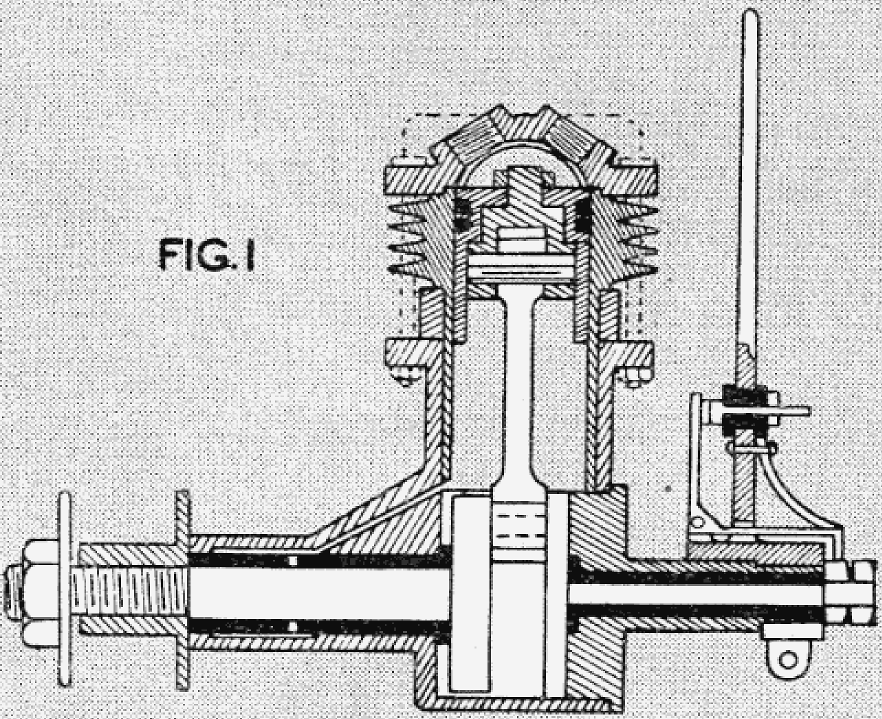
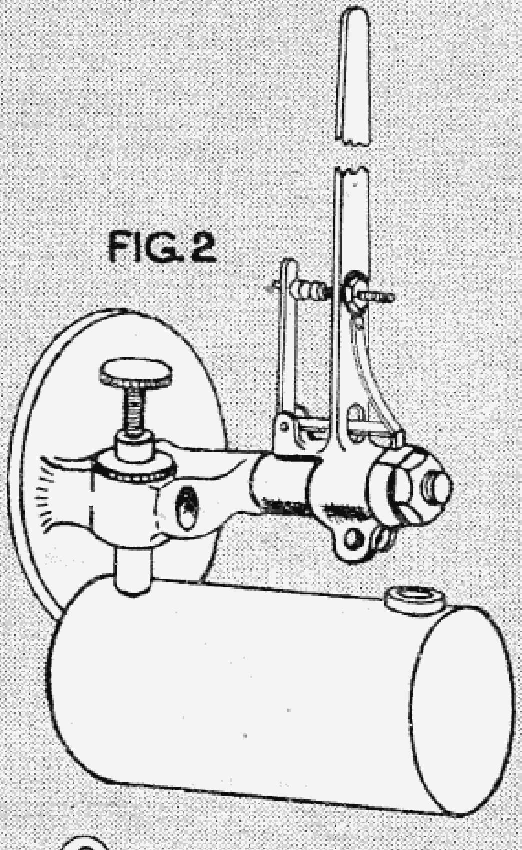


FIG. 2



F.IG. 4

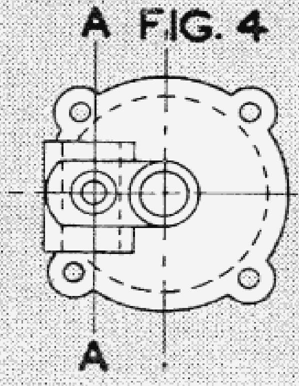


FIG. 5

SECTION A.A.

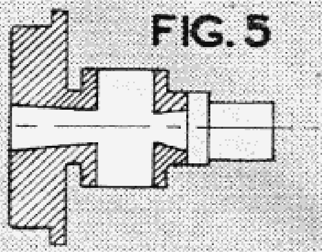


FIG. 3

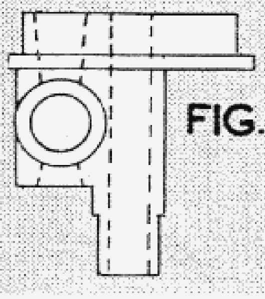
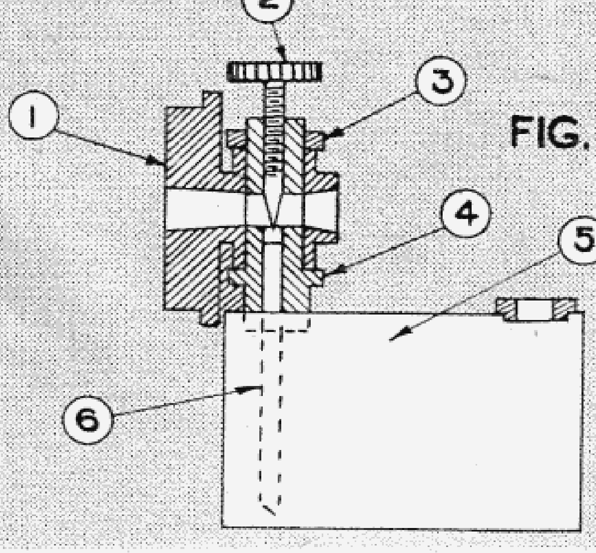
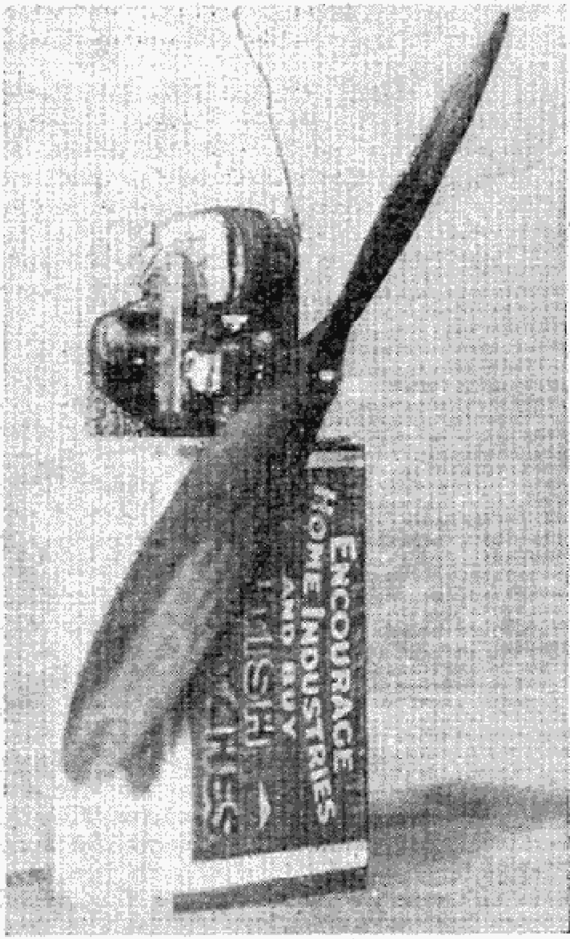


FIG. 6



AN ELECTRIC R.T.P. MODEL

BY ALAN SLACK



THE chief interest of this article is the electric motor, the weight of which is only ⅞ of an ounce, and I believe is the smallest motor that has flown a model aircraft. The motor can easily be fitted to any type of fuselage. I made the motor as an experiment, and when driving a prop. the thrust felt good enough to justify trying it out on a light-weight model.

The next job was a plane to experiment with. After looking over some old models I came across one I thought would do. The wing span is 24 ins., and the area 72 sq. ins. The first section of the fuselage was cut off, the motor fixed to a thin ply former, and secured in position with two rubber bands. The total weight was 1·56 ounce. A camera tripod was used as a " pole ", for which a distributor was made to fit the screw at the top.

It was decided to have a trial on the asphalt square at the back of the house. This gave a maximum radius of 5½ ft. from the top of the tripod to the centre of the model. The wire used was 25 gauge D.C.C. copper. A few twists were given to the few wires to prevent them separating, and the outer end attached to the wing tip one-third from the leading edge. They were fixed to the wing tip with cotton, then passed under the wing to the motor. The bulk of the weight is concentrated in the motor right at the front of the fuselage. This meant that the wings had to be well forward, and if the motor was used in a scale model it would have to be placed further back, and a separate prop. shaft used long enough to engage with a driving fork on the motor shaft.

The first trial was with current supplied from the mains through a transformer of about 6 to 8 volts, but it was found that with the voltage drop due to the length of the wire, and low amperage, there was barely enough juice to fly the model. However, with a sharp push the machine did leave the ground and " hedge-hop " at a height of about 4 ins. This was not very satisfactory, so the transformers were replaced by three 2-volt accumulators connected in series. This made a great difference, and with the tripod about 30 ins. high the model gracefully took the air after a run of about 15 ft. It soon reached the height of the tripod, and flew round and round consistently at a speed of 11½ miles per hour. The accumulators were placed between the tripod legs, and as such a " trivial matter " as a switch had been overlooked in the excitement, it was found necessary to run in and catch the model—a feat at which one can rapidly become expert.

The next trial was with a wing of 90 sq. ins. area on the same machine. It flew excellently, but at only 8 miles per hour, and it seemed more susceptible to the breezes it encountered at this speed. All timing was done by stop-watch. A 20 volt, 5 amp. transformer has now been successfully used. This has a starter, each stud rising by 2 volts, so enabling the voltage to be varied. The longest flight to date has been around three minutes, and although the motor gets rather warm there has never been anything to worry about.

Construction of Motor.

The field and armature were sawn and filed to shape from ⅛ in. thick sheet-iron. The gap between field and armature should be as small as possible. Two holes are drilled in the field, as shown, for the two studs 11/16 in. long which are soldered in. On each stud a washer was soldered for the fibre back-plate to fit up to. The field was wound with 100 turns of 24 gauge enamelled wire, and the armature has 40 turns of 28 gauge wire on each pole. Both field and armature are connected in series.

The commutator body was turned from fibre, and drilled a tight fit on the shaft. A disc of brass about 1/64 in. thick was cut to the shape shown, and cut into three equal segments. Each one was drilled to take a small brass nail, the holes being countersunk on the outside. Corresponding holes were drilled in the fibre disc of the commutator. The small brass nail is passed through the fibre disc with its head on the outside, then through the hole in the segment with the countersink on the outside. With the two pressed together, and the head of the nail resting on something solid, a spot of solder is applied around the countersink with the nail protruding. The lugs on the periphery of the segments are bent over the fibre disc, and besides securing the segment at its outer edge, are used to solder the wire leads to and from the poles of the armature. The ends of the nails are cut off, and filed flush with the brass segments. Riveting would be hopeless with such thin brass. The commutator is assembled on the shaft with the gaps in the segments opposite the poles of the armature.

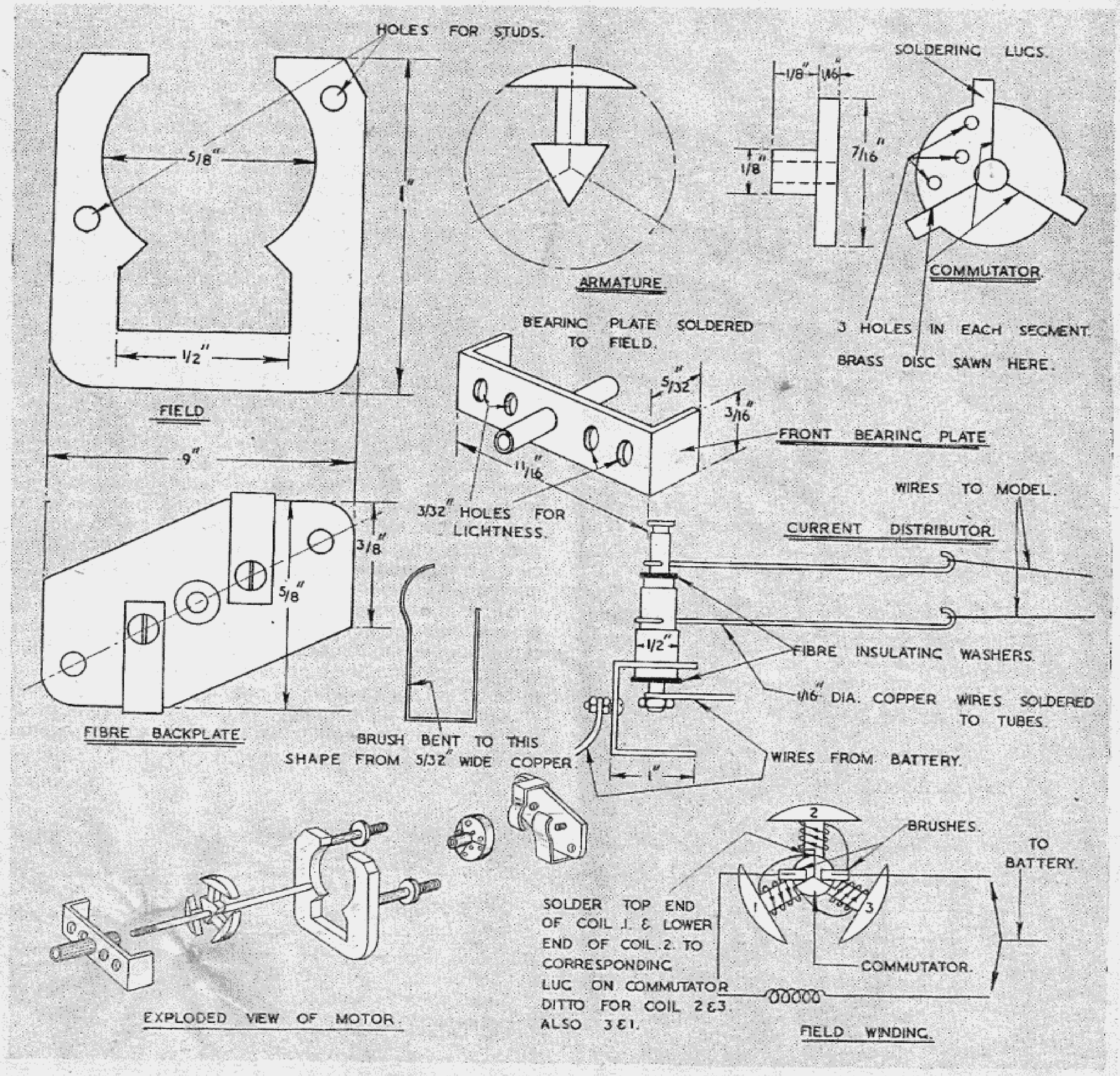
For the front bearing a strip of sheet brass about 1/64 in. thick was cut and bent as shown. This was drilled to take a piece of brass tube soldered in to form the bearing and lightened with four 3/32 in. holes as shown.

The back-plate is of fibre 1/16 in. thick, drilled to take the bearing tube, which must be a tight fit in the hole. The two brushes are attached to the back-plate, and the assembly then mounted on the two studs which extend from the field magnet. The brushes are of copper foil bent to shape, and secured by small screws which screw into the fibre.

The shaft is a piece of 1/16 in. straight steel wire, screwed at its front end 1/16 in. Whitworth to take the retaining nut for the prop. This is about all of the motor, which should be a simple job for the average modeller. The propeller is 5 ins. diameter, carved from a hardwood block, ½ in. wide, and ¼ in. thick, the weight of the motor and propeller being only ⅞ of an ounce.

The distributor is screwed to the top of the tripod, and has given no trouble whatever. The drawings show its construction clearly, and it is simple to make. The body is a piece of sheet brass 1/16 in. thick. Passing through the top of this is the copper or brass rod, insulated from the brass sheet by the fibre bush. Around this bush is the lower brass tube which makes contact with the body. The tube is a tight fit on the bush, but the tube which revolves around it must be an easy fit. A fibre washer fits over the upper end of the centre rod, and rests on top of the bush and fixed tube. This insulates the upper piece of tube, which should revolve freely around the centre rod. The length of copper wire bent and soldered to each of the rotating tubes is important as they give a positive rotational motion to the tubes, whereas the thin wire passing out to the model may have a tendency to wind round them. The contacts from the transformer are attached, one to the body, and the other to the bottom of the centre rod.

In conclusion, I would say that here is a good opportunity for anyone who has run out of rubber, and has any models he would like to see flying again, to do so without a lot of trouble, and in a very novel way.



repeated use, and yet will, when added to the irreducible weight of engine and all its accessories, weigh as little as ¾ lb. The difference in strength and immunity from tears in hedges, etc., between silk covering and tissue or even bamboo paper coverings is out of all proportion to the slight saving in weight, and one of my chief joys on first flying silk-covered petrol models was arriving home at the end of days of gruelling flying including landings in trees and hedges and finding no repairs and patching of the covering necessary.

Since writing the above, I have had an opportunity of trying one of the new silk substitutes (called PLANE-FILM), and though it is too soon to come to any conclusions on its long term durability, or whether in the course of time it becomes brittle or not, it is certainly much lighter than silk and seems immensely strong. It is an impervious film, somewhat like cellophane in texture, slightly elastic and therefore capable of covering compound curves, and because of its impermeability, requires much less weight of dope than is required to fill the interstices of silk.

The really small petrol model may sound attractive, especially if an ideal flying ground with really short grass is always at hand, but I certainly don't recommend it as a beginner's model, and it does not give the characteristic performance of the larger model, and most important of all, with few exceptions, the very small engines under 4 c.c. (*i.e.*, approximately ·225 cu. in. by American classification), were not quite as easy to manage as their larger brethren of around 6 c.c. and over. Obviously the smaller the model, the less latitude exists for increase in weight with age. Even rubberears know how the weight of a model gradually goes up with minor repairs, modifications, additions and absorption of rubber lubricant, etc. These are all proportionately bigger on petrol models but the addition of 1 oz. on a 3 or 4 lb. model makes little difference to the wing loading.

I have flown models with loadings of 1½ lbs. per sq. ft., but I don't like it, nor do their undercarts. Although the theorists will tell you that the only effect of increasing wing loading is to increase the gliding speed (*i.e.*, the *forward* speed), I am quite convinced that the sinking speed also increases on a badly streamlined model, and on a small model under 5 sq. ft. in wing area, the weight of undercart strong enough to stand up to repeated landings at wing loadings of over 1 lb./sq. ft. becomes disproportional to the total weight.

Going to the other extreme of light wing loading has never been one of my failings (or successes !). In this country we have nearly all " built fairly heavy," but in America petrol models with loading of under 8 ozs./sq. ft. have been fairly common. I have seen models of this loading in action, and personally I don't like their behaviour either under power or on the glide as much as a more heavily loaded machine, and when it comes to landing they are too inclined to bounce off into a stall, instead of sticking to the deck.

For all (reasonable) weather flying I would recommend a wing loading of between 10 and 14 ozs./sq. ft. The outstanding difference between the flying of petrol models and duration models is their landing. There is bound to be a certain element of luck in the sort of air conditions met with just before touching down, especially in " bumpy weather," but it is here that the more heavily loaded model scores, as it is less affected by inequalities in air density and velocity near the ground and is therefore more likely to make consistently good landings. Another point of prime importance in the flying of petrol models is to ensure that there is no tendency to stall. So far as the landing of a duration model goes, slight degrees of stall do not matter very much as the model probably noses over in any case and no one seems to care (though personally it gives me " the willies "), but this sort of thing on a petrol model may lead to quite serious damage. It is absolutely essential if consistent and crash-free landings are to be made that the glide is steady and free from any stalling tendency. However gentle the stall, switchbacking ensues and sooner rather than later the model will touch down at just the wrong point of the switchback and either dive in and nose over or bounce high and probably stall within a few feet of the ground.

The fitting of built-in or " letter-box " slots to wing tips has come in for a certain amount of criticism of late and I have heard it said that they make not the slightest difference to a model's stalling tendencies, and even that they increase such tendency, as proved by covering them over with silk or gummed paper. I think there is no doubt they are not quite as effective as Handley Page slots on outriggers, but they are less easily damaged and certainly add less drag, and if properly designed and positioned, without unduly blunting the leading edge of the shortened airfoil behind them, they undoubtedly work very well. At all events the use of *good* slots, which *do* work, help a model to negotiate the above-mentioned hazards including that very likely stall following a bounce landing, and I still intend to build them into all my wings, both land 'planes and flying boats.

Basic Principles of Model Aircraft Engines:

Quoting from the letter from the reader who finally urged me to write this " beginners' instalment " of Petrol Topics, he states : " How many, I wonder, are, like myself, ' lone hands ' who know no experienced ' petroleer ' and whose knowledge of an engine could be stated in a few words : An engine derives its power from petrol and oil ; is about the size of the palm of your hand and weighs about 3–5 ozs. ? Probably the majority of these enthusiasts who are ' itching to get cracking ' have never even seen an engine stripped." He goes on to ask for a simple explanation of the working and parts of an engine.

In my book on engines I laboured the point that hitherto we have not seen a *model aircraft engine* pure and simple, designed throughout and exclusively for the job we aeromodellers call upon it to do. There were plenty of new makes and new models of old makes, but nearly all followed preconceived notions of general layout based on marine and stationary two-stroke engines. This layout is by no means ideal for our purpose, and there is a great deal of room for improvement in post-war designs, of which I hope we shall not have to wait much longer for concrete evidence. Pending the production (I hope in Britain as well as America) of new designs, I base my remarks on engines obtainable before the war.

I think it may be simpler to start with the prop. (the only thing that is common to rubber and petrol-powered models) and work backwards. The prop. is mounted on a shaft (usually ¼ in. diam.) and is driven by a disc known as the driving washer whose front face has either spikes or serrations to bite into the wood of the prop. A nut (sometimes in the shape of a spinner) and washer clamp the prop. hard against the driving washer. The shaft itself is usually hardened and ground steel and carries on its inner end a crank pin and counter balance weight, and it revolves in an accurately-fitting bush or bearing, sometimes bronze, sometimes dural or other suitable alloy. Power is conveyed to the crank pin by the usual piston and con-rod or connecting rod of any reciprocating engine, whether steam or internal combustion. In a steam engine power is applied to both sides of the piston alternately giving both a push and pull action, but in internal combustion engines the power is applied on the far side of the piston only, and the momentum thus gained by the revolving shaft and counterbalance weight carries the shaft and prop. round the greater part of a complete revolution, so pushing the piston to the top of its stroke again and ready for the next application of power.

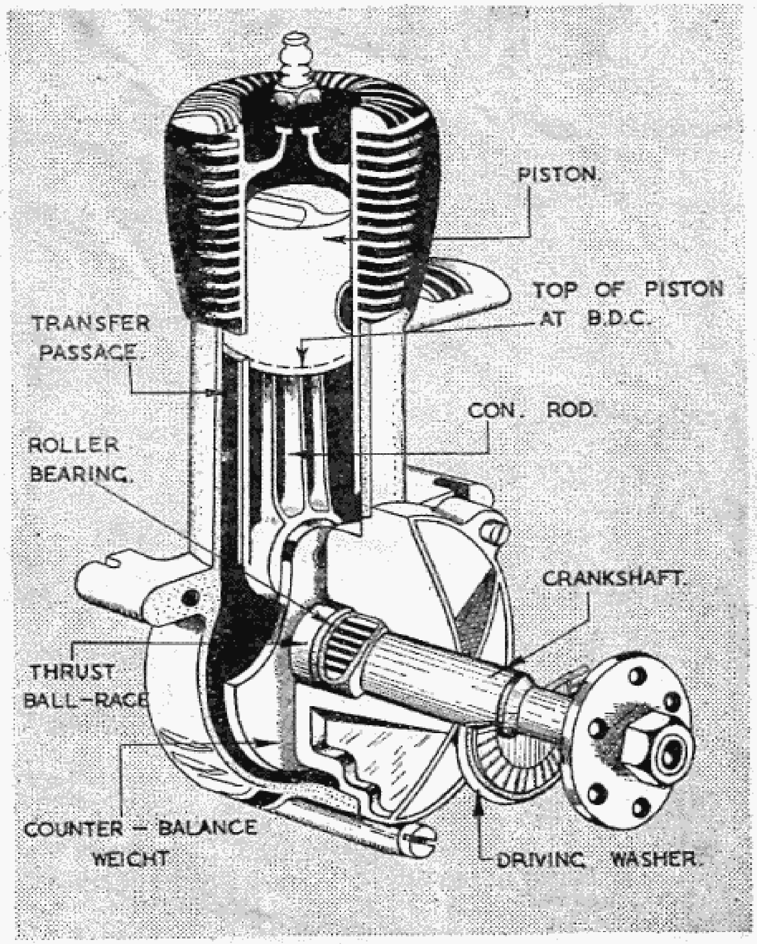
The piston slides up and down an enclosing cylinder, the one being an exact and gas-proof fit within the other. Some pistons are fitted with cast iron spring rings, but most are accurately lapped into their cylinders and to begin with are at least as gastight as those fitted with rings, though they may not wear quite as long as rings. The end of the cylinder is of course closed by what is called the cylinder head, which may or may not be in one piece with the cylinder itself, and through this is threaded the sparking plug with a gastight washer.

A mixture of vapourised petrol and air is introduced into the cylinder and compressed by the piston until it reaches the end of its stroke towards the cylinder head. The ratio between the volumes of the space in the cylinder head into which the mixture is compressed and the volume of the mixture before the compression stroke begins is known as the compression ratio, and this is so arranged that when the compressed mixture is ignited by a spark from the plug, it does not detonate or instantaneously explode, but burns at a definite rate causing progressive expansion of the gas, thus forcing the piston down the cylinder and turning the crankshaft *via* the con-rod.

The peculiarity of a two-stroke engine is that the complete cycle of events takes place in one revolution of the shaft involving only two strokes, one up and one down, of the piston. The more usual four-stroke engine used in cars and aero engines, etc., is much more efficient, but involves the use of valves timed to open and close at half the crankshaft speed, thus entailing another shaft (the cam shaft) and its reduction gearing from the crankshaft. The only moving parts in a two-stroke engine are the piston and its "gudgeon" pin on which the con-rod pivots; the con-rod and the crankshaft.

Whereas in a four-stroke the gas is *first* sucked in through the inlet valve (downstroke), *second*, compressed while all valves are closed (upstroke), *third*, ignited to give the firing stroke (downstroke), *fourth*, exhausted through the now open exhaust valve (upstroke), giving almost complete scavenging or clearance of exhaust gas. In a two-stroke, the crankcase in which the crank and counter balance weight revolve is utilised as a receiver of mixture, and while the piston travels to the top of its stroke compressing the gas in the cylinder head, it simultaneously sucks mixture into the crankcase either through a port or opening in the side of the cylinder uncovered by the piston at its point of "top dead centre" or through an opening in the side of a hollow crankshaft or through a hole in a disc rotating with the crankshaft within the crankcase, timed to open and close at or near the point of revolution at which the piston is at top dead centre.

As the piston returns on the firing stroke, the mixture trapped in the crankcase becomes compressed and just before bottom dead centre is reached the piston uncovers two more openings or ports in the cylinder wall. The larger one which begins to open a little before the smaller one is the exhaust port through which the spent explosion projects the usual delightful stink and blue smoke associated with petroleers! The smaller and later opening port is the transfer port and allows of the transfer of the already compressed mixture from the crankcase to the cylinder.



On most engines the piston top is so shaped that this incoming jet of mixture is directed upwards to the cylinder head so assisting to drive out the remaining exhaust gas, but it is obvious that in a two-stroke engine there must be *some* mixing of exhaust and incoming gases as complete scavenging is not possible. Much research has gone on over many years in the placing of ports and in the shapes of piston tops and deflectors, and even amongst full-size engine designers there is no one and only final way of obtaining the highest efficiency.

The conditions governing the perfect operation of this two-stroke cycle of events at the seemingly amazing speeds of 5,000 and even 10,000 times per minute, would take at least an article in themselves to describe, but I need a long breath before proceeding! They entail the description of the induction and ignition systems, and what is far more important, their intelligent operation by the budding petroleer. All of the foregoing occurs whether the operator likes it or not, and what he is far more directly concerned with is providing the fuel in the right proportion, *i.e.*, the petrol/air ratio and the means of consuming or combusting it, *i.e.*, a nice fat spark at the plug points at the right moment. Next month I will attempt to describe some of the most widely used systems, and my own, possibly unorthodox methods of operating them!!

FROG TRADE MARK

"175"

MODEL AERO ENGINE

(ILLUSTRATED FULL SIZE)

SPECIFICATION

Type :	Rotary Valve Two Stroke
Capacity :	1·75 c.c.
Bore :	·5″
Stroke :	·55″
Speed :	600—6000 r.p.m.
Airscrew :	9″ dia., 5″ pitch
Static Thrust :	·75 lb. at maximum revs.

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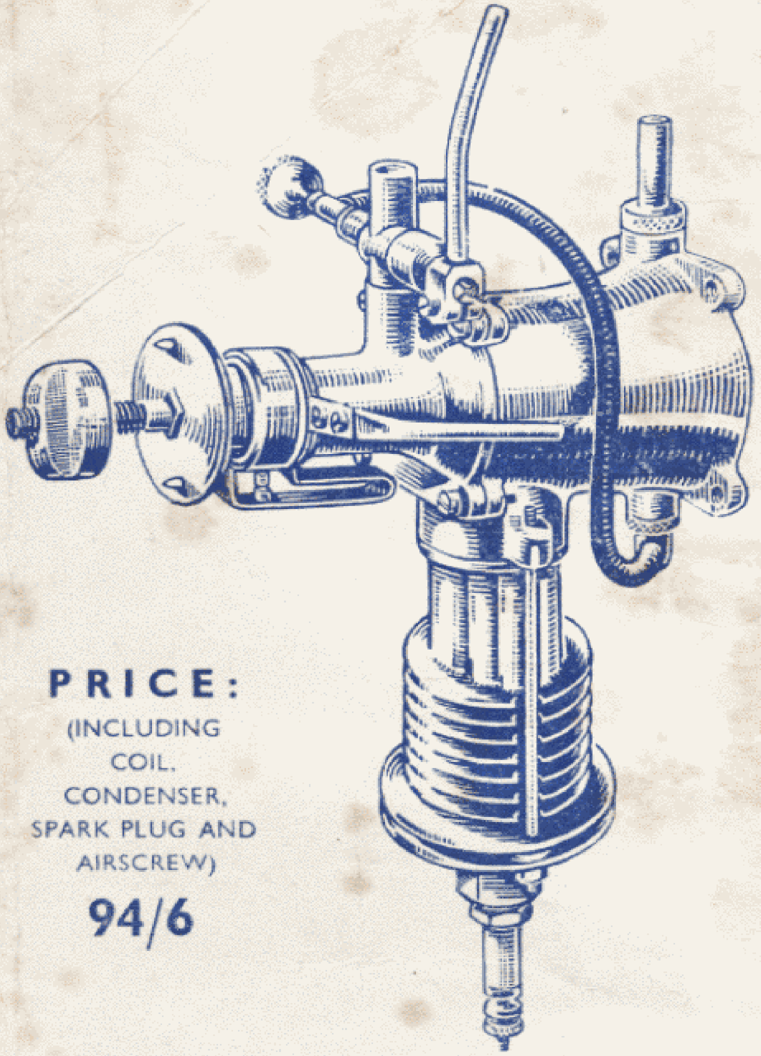

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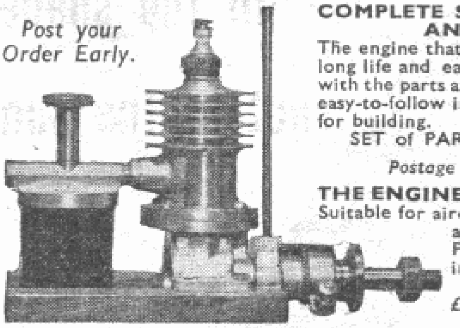

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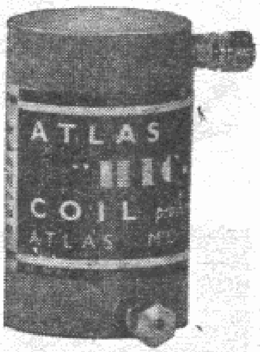

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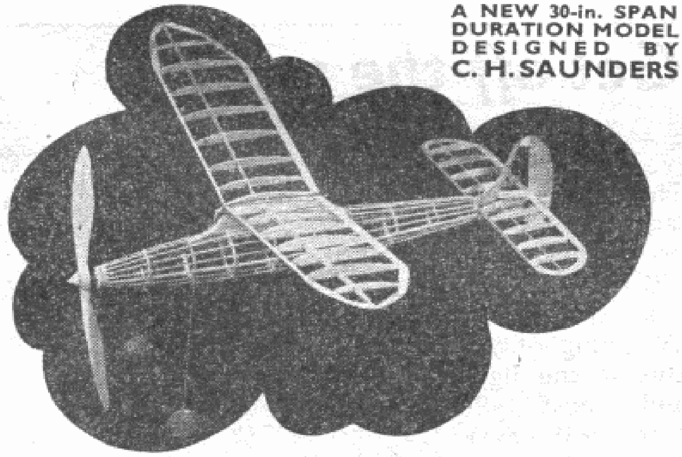

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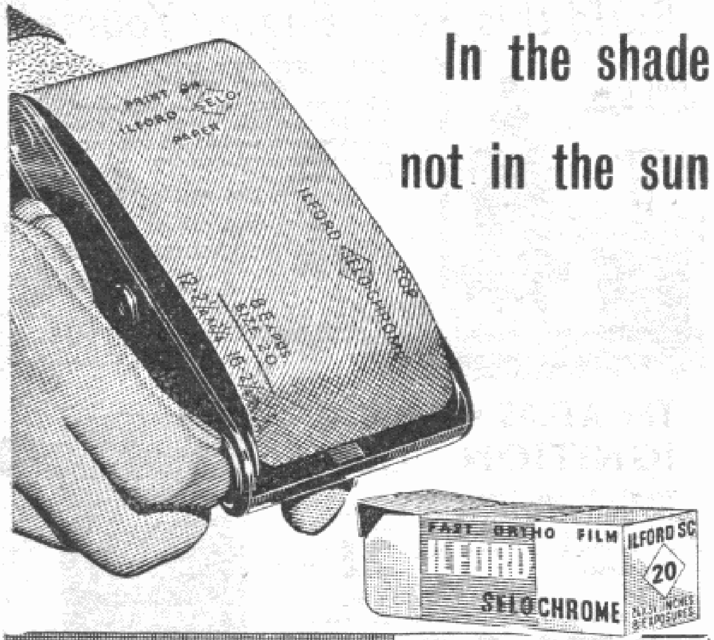

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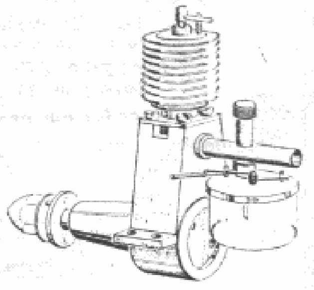

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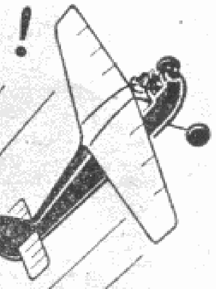

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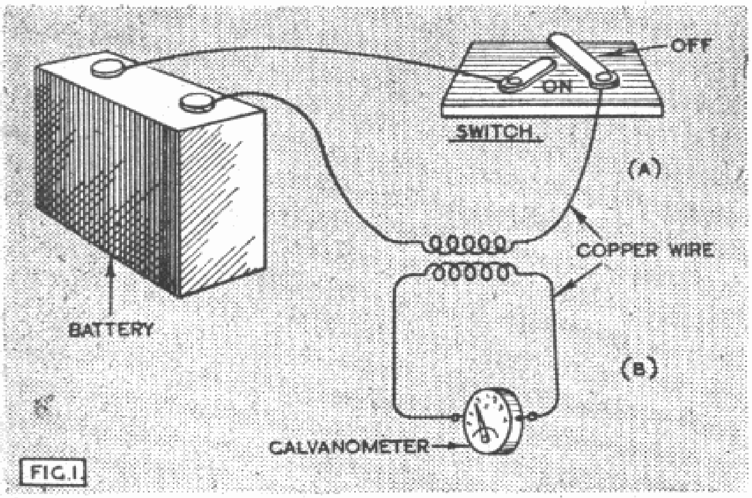


FIG. 1.

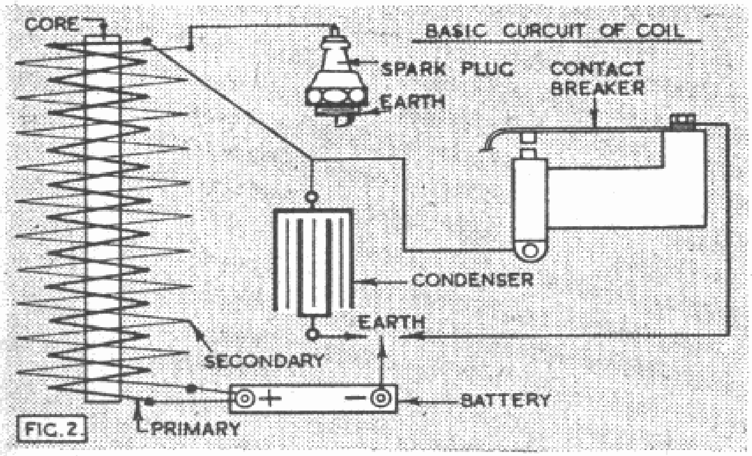


FIG. 2

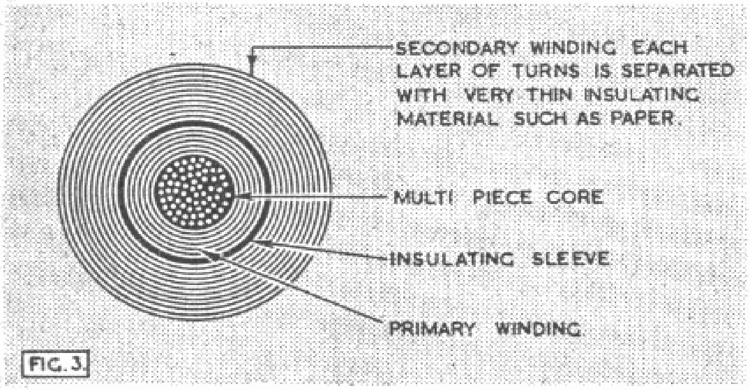


FIG. 3.

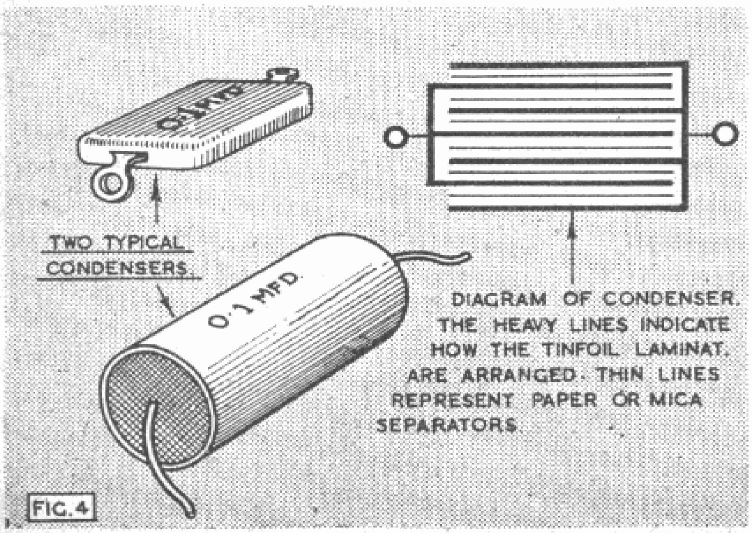


DIAGRAM OF CONDENSER. THE HEAVY LINES INDICATE HOW THE TINFOIL LAMINAT. ARE ARRANGED. THIN LINES REPRESENT PAPER OR MICA SEPARATORS.

FIG. 4

Ignition Coils.

Today ignition coils are usually referred to (in our sphere) as spark coils, ignition coils, or just coils. But the older and more correct title is inductive ignition coil. According to the dictionary, Induction (Elect.) means: (1) The production of an electric or magnetic effect by one body upon another without contact. (2) An electric or magnetic condition produced in a body when placed in an electric or magnetic field. This is the basic principle on which our spark coils depend. This induction principle can easily be demonstrated (see Fig. 1A). Here you will see a simple electric circuit composed of a battery and a switch connected up by wire. The switch, you will notice, is in the *Off* position. If we place a second circuit in close proximity to the first (see Fig. 1B), composed this time of a coil of wire with its ends connected to a galvanometer (a sensitive instrument for recording electrical current), we can show that by manipulating the switch *On* and *Off* the galvanometer needle will be disturbed and will flick backwards and forwards in sympathy with the switch contactor.

Now, in a spark coil the first circuit of our experiment is known as the *Primary* and is a length of insulated wire wound round an iron *Core*. This core helps to promote the induction phenomena (see Fig. 5). The ends of the coil are connected as before, but this time, as the switch will be mechanically operated, it will henceforth be termed a *Contact Breaker*, and instead of saying it's *On* or *Off*, we will say *Closed* or *Open*. This, so far, with one exception (the condenser), is the primary circuit. The secondary circuit is brought in close proximity by winding it over the primary windings with often a thin, insulated sleeve separator (see Fig. 3).

The two ends of the secondary coil are connected to the sparking plug and earth respectively. The current developed in the primary coil is induced into the secondary coil. The intensity of the current flowing through the two circuits is governed by the thickness and length of the wire used in each circuit. In practice, the windings of the primary consist of, for example: 200 turns of 26-gauge enamel-covered copper wire, and the secondary of 12,000 turns of 46-gauge enamel-covered copper wire. This is very thin wire indeed. A difference in the ratio of turns of 60–1 is probably the average for modern ignition coils. You will find on looking at the complete wiring diagram (Fig. 2), which will be gone into presently, that the circuit is a bit more involved than just described. More experienced readers, however, must be tolerant for the benefit of the younger and inexperienced, who must be considered.

The Condenser.

Reference was made just now to the condenser. This is the little joker that is sometimes blamed for the more obscure of engine troubles. It rarely meets with any respect or consideration, or, for that matter, any care. It happens, however, that this little morsel of mystery is very essential, and a glimpse into the task it has to perform will be sufficient to see why it should merit as much care as any other vital part of your power unit. First of all, what does it do?

The answer given to this question is invariably " It prevents undue sparking at the contact breaker points."

MODELLING

POWER MODELLING BY G. W. W. HARRIS

This answer is of course correct, but unfortunately misleading, because it is inadequate. It is apt to leave our novice with the impression that if it only reduces sparking at the C.B. points it cannot be very important—"after all, what's a few sparks matter?"

We must revert to basic principles for a moment. When the current from the battery flows through the primary windings, the iron core is magnetised; the current flows for that brief time when the C.B. points are closed; when the points open, the current ceases to flow and the iron core is de-magnetised. In the interests of efficiency this de-magnetisation must be extremely rapid, and it is the task of the condenser to remove the self-induced current from the primary by absorbing it, thus bringing about an instantaneous collapse of the magnetic field. Actually, there is a current surge that takes place between the primary and condenser. The speed of this surge is something like the speed of light (180,000 miles per sec.). That the self-induced current exists is shown by testing an ignition circuit without a condenser connected across the C.B. As the points open a fat spark will be observed and heard jump across the opening points. With a condenser shunted across the C.B. points there will be but the faintest of sparks.

A condenser is composed of sheets of tinfoil, separated by a non-conductive material such as wax-paper or mica (Fig. 4). The sheets of tinfoil are connected up as shown. For convenience, this little lot is rolled up and fitted inside a cylindrical container.

It will now be obvious to you that the condenser is not to be ill-treated. If it is the type that has protruding wire tags, great care must be taken when soldering the connections that the condenser is not heated, or trouble will be sure to follow.

Some condenser cases are not oil- and petrol-proof, so care should be taken to see that they are not in a place where they can be so affected. Condensers should be fitted as near to the C.B. as is reasonably convenient.

Contact Breaker.

Because this item is mechanical, it's the weak link of the ignition system; regrettable, but true. Any bother that emanates from this source often causes trouble elsewhere in the circuit. For instance, fouled points will often for various reasons be the cause of that state of affairs when one happens to inspect the coil and finds that it's resting in a pool of pitch and paraffin wax—unless your coil happens to possess a hermetically-sealed case which won't leak. The internals will then probably be stewing in their own juice, so to speak, and you may at the time be none the wiser. For this reason, when engine-starting trouble is prevailing, it is desirable to form the habit of feeling the coil for signs of warmth. If it is unduly warm, then let it cool before continuing any further tests.

We know already that a low voltage is sent through the primary windings of the coil and that this current is interrupted by the contact breaker; also that these fluctuations (influenced by the condenser) induce a very high voltage current into the primary. The high tension voltage can be anything between 10,000–20,000 volts. It will be obvious that for two-stroke engines the contact breaker must make and break every revolution of the crankshaft. This means that any working, or rather moving parts, involved in the contact breaker must be

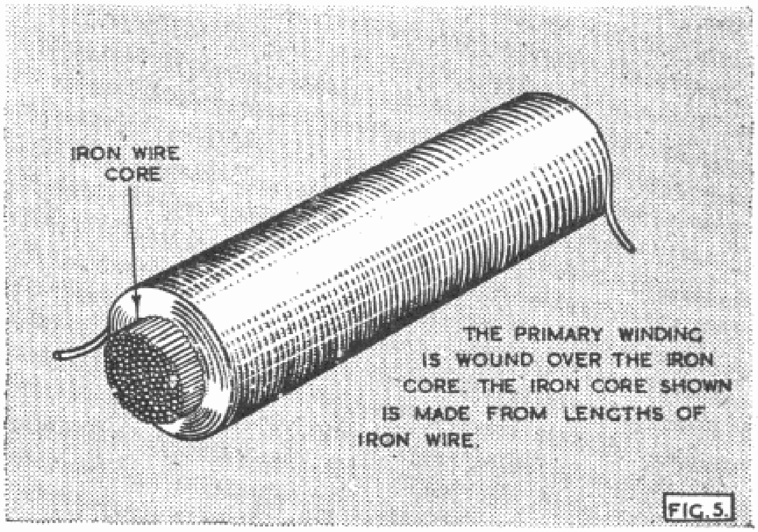


FIG. 5.

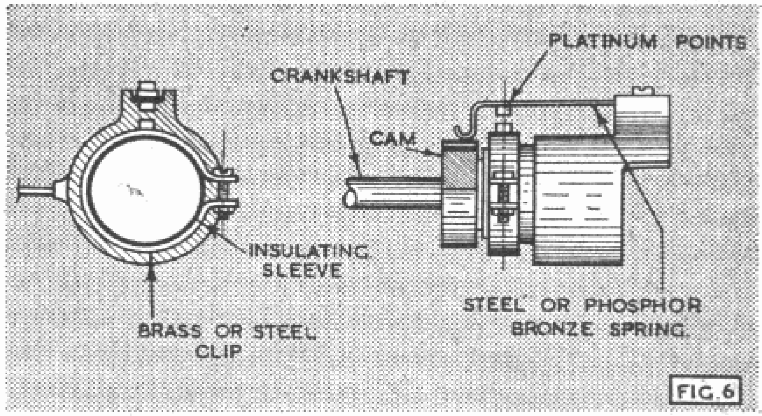


FIG. 6

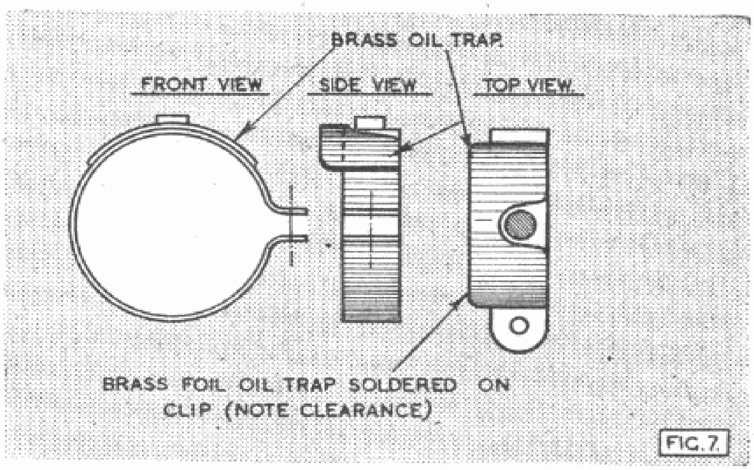


FIG. 7.

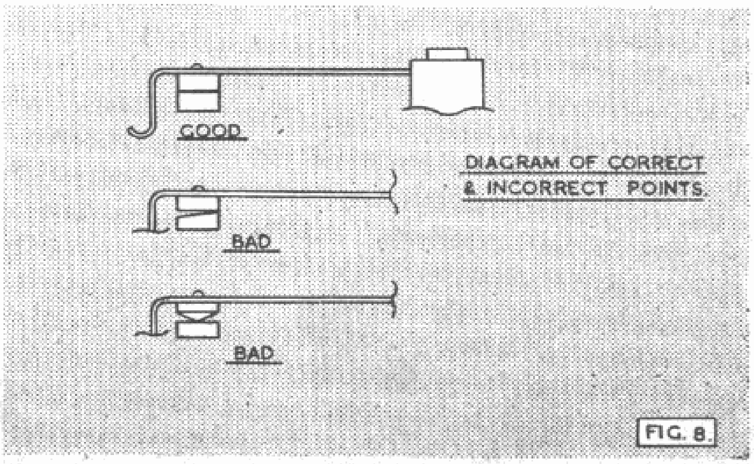


DIAGRAM OF CORRECT & INCORRECT POINTS.

FIG. 8.

light, strong (*i.e.*, stiff), and friction must be kept to a minimum. Fortunately for us, one of the most efficient and trouble-free types is also the simplest (see Fig. 6). This type is fitted to many makes of engines. The spring is usually phosphor bronze. One snag with this type of C.B., and many others for that matter, is that oil thrown out by the crankshaft makes its way up the face of the main bearing bush across the insulated clip, and finally accumulates around and between the C.B. points. To reduce this possibility I have tried fitting a small oil trap or retainer around the base of the fixed point. This scheme when tried out on a Bunch Tiger engine and two home-made engines has proved to be very successful, and I recommend its adoption to those who find trouble in this direction. (See Fig. 7.)

While we are on the subject of C.B. points I feel I must emphasise the absolute necessity for the point faces being not only kept clean, but smooth to a degree of mirror-finish. They must be flat and mate up evenly *all* over their faces (see Fig. 8). Partial contact causes high resistance, misfiring, sparking and erosion of the points. Some writers have suggested that the points, or one point, should be rounded off, *i.e.*, convex. Just how this idea came about I do not know, unless possibly they happened to hear or read a few years ago that certain aircraft magneto points were to be so treated; if so, then it should be pointed out here that this order was confined to a certain mark of magneto which was fitted with special points, and that the idea was that the rounded point bedded *itself down.* The only way a smooth, bright finish can be imparted to contact breaker points is by stoning. To do this it is necessary to dismantle the fixed point and with a small oil stone resurface it until it is is shiny and true, fit the moving point in place and check up the alignment of the faces; look for the high spot. Now remove the top or moving point again and proceed to re-surface it—bearing in mind the high spot that has got to be removed. Once this task has successfully been accomplished, subsequent cleaning will be confined to wiping with slips of paper only, for many a long day. Filing will not be necessary or desirable. Experience has shown that for our purposes magneto files are definitely unsuitable.

To be continued.

Readers' . . . . . . Letters

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

DEAR SIR,

I visited Eaton Bray on Sunday, August 25th, which was the second meeting of your International Week, and since this was my first visit I felt that I should like to pass you word of appreciation.

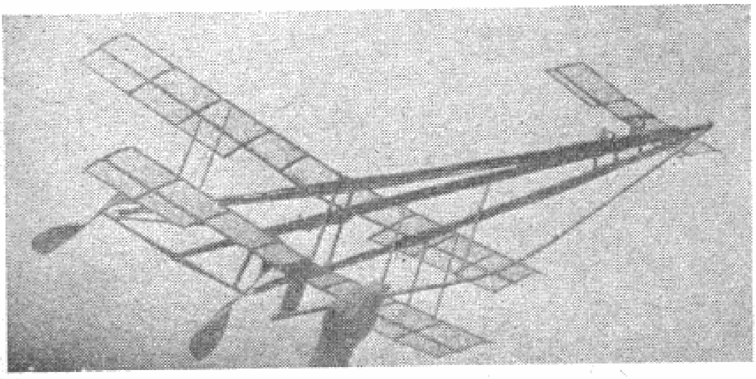
I had previously heard quite a lot about Eaton Bray, and had also heard quite a bit of criticism, but I must say that my visit dispelled any justification for criticism. I was very impressed with the general lay-out of the whole place, and particularly so with the organisation and the running of the various competitions.

Whilst you already have two large circular concrete take-off discs on the ground, I understand that these are going to be augmented by a further four or five in due course, and I cannot help feeling that it is a great pity that this Model Aeroplane Drome cannot be made the recognised rendezvous of all International and National Centralised Contests in this country.

It is well situated " amidships " our Island, and the general geography of the whole place makes it, in my opinion, ideal for the job. It is my belief that the average modeller interested in competitions would welcome some fixed point for these competitions rather than having the present position with no fixed " home." This will certainly not be my last visit to Eaton Bray.

Incidentally, talking of canards, what about this? Built and flown in 1916!

Birmingham. H. J. TAPLIN.



DEAR SIR,

Although my experience with engines is quite limited, it extends over some years. Here is one point which may help modellers.

An engine without cowling forces the air directly backwards over the petrol tank, past the filler cap, probably fitted with an inlet hole.

I have found that this condition produces a powerful suction (acting over the hole like a spray). This spray of petrol can extend several feet to the rear—resulting in wasting petrol and opposing the suction on the jet feed. By placing an inch of plastic tube on the filler cap and slicing it off to a point like a cat's ear, with the ear facing the airscrew, the result is now a pressure air feed into the tank. With my engine (a 2·5 c.c.) it has completely cured a very puzzling habit of irregular running and frequent stoppage.

Mr. Graham Saxby wrote a very interesting letter concerning a creature which had worried him by ticking. The description and drawings are very accurate. They are wingless insects known as booklice or psocids and are very common in most homes. They are very fond of starch paste, and this would account for their presence on the model.

Reading. W. A. SMALLCOMBE, B.Sc.

Also confirmed by several other Aeromodelling Entomologists. (ED.)

DEAR SIR,

I have read your article on the thermo-electric primer and also of the difficulties which arise from rubber tubing when used for connections. I should like to point out that if polyvinyl chloride tubing is used no difficulties will be experienced, as this plastic has a very high resistance to solvents. This tubing is now available commercially and can be bought at any hardware or electrical shop.

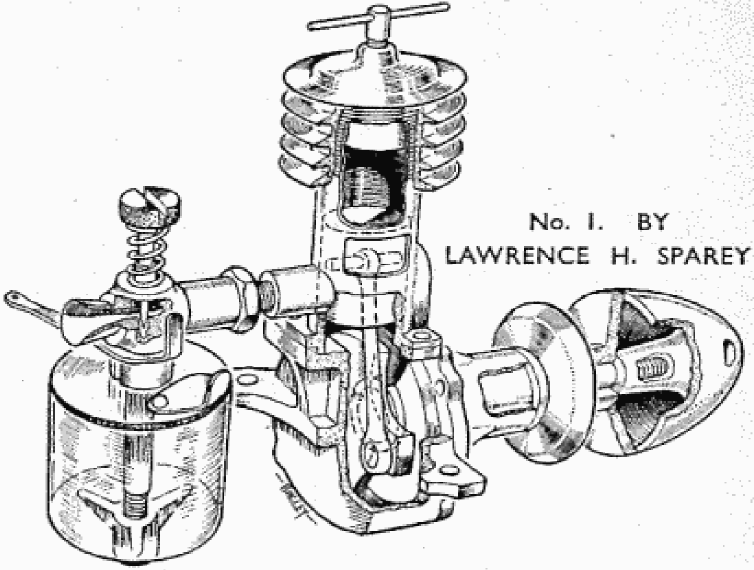
Co. Durham. LEO A. CULLINAN.

DEAR SIR,

I see that in the A.M. recently Lt.-Col. C. E. Bowden mentions that the capacity of the Ohlsson 23 is 4·3 c.c. If anyone troubles to work it out they will find that it is really 3·8 c.c.—a difference of ·5 c.c. I hope that you publish this letter or make some note in the A.M. in the very near future, as nearly every modeller seems to think that it is 4·3 c.c. I heard it mentioned twice at the Northern Area Rally which I attended yesterday, and each time it was described as 4·3 c.c.

Halifax, Yorks. D. STOLLERY.

Engine Analysis



No. 1. BY LAWRENCE H. SPAREY

As this is the first of a new series, a few words of introduction would not be out of place. It is our intention to deal in turn with each and every British engine, both petrol and diesel, that is on the market, giving the fullest possible information available. General information is being supplied by the manufacturers and the actual testing carried out by our well-known staff contributor, L. H. Sparey, whose experience of miniature motors and model engineering numbers twenty years or so. In addition to accurate three-view drawings, cut-away perspectives, and performance graphs, details of a specially designed AEROMODELLER airscrew will be given for each engine. These airscrews are being designed by P. R. Payne, better known as John Halifax, another well-known contributor of ours, who is working in close co-operation with Mr. Sparey in this respect. Every engine that appears in this series will have been tested on the same equipment thus ensuring comparative results and we would emphasize that considerable care and thought has gone into the test equipment used in order to maintain the highest possible accuracy.

TEST

Fuel. Recommended fuel was used.

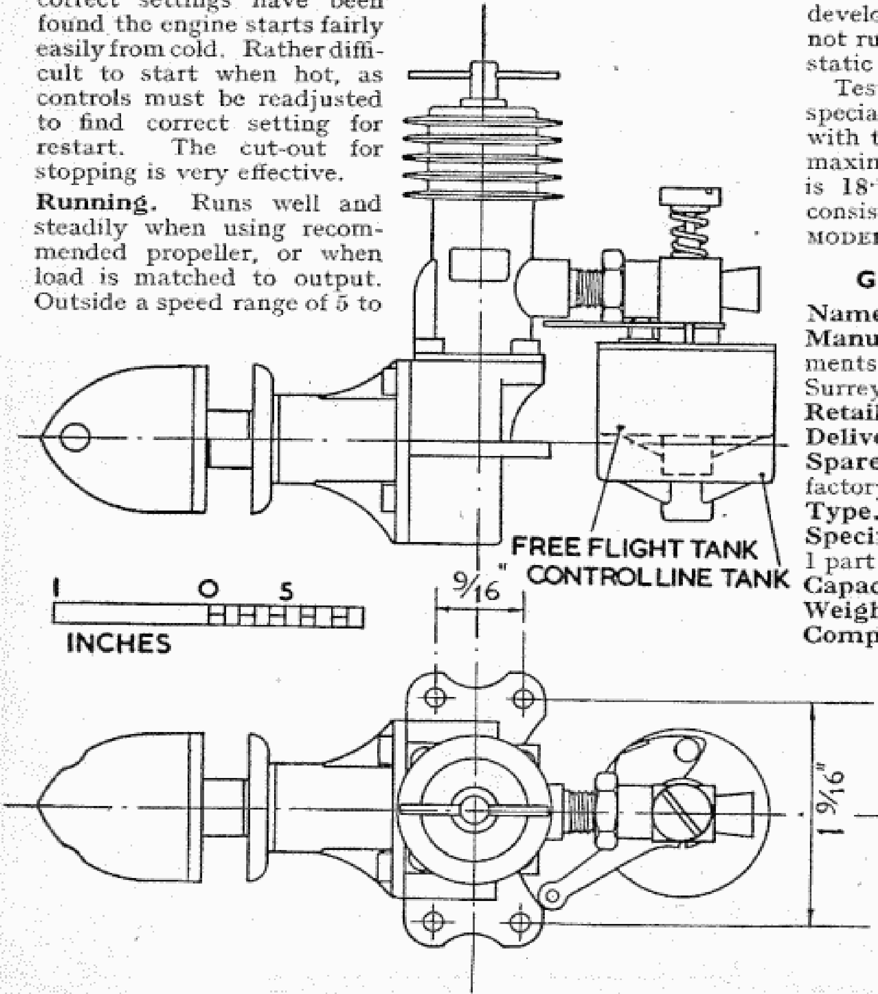
Starting. Hand starting was used throughout. Once the correct settings have been found the engine starts fairly easily from cold. Rather difficult to start when hot, as controls must be readjusted to find correct setting for restart. The cut-out for stopping is very effective.

Running. Runs well and steadily when using recommended propeller, or when load is matched to output. Outside a speed range of 5 to 7,000 r.p.m. engine "hunts," and it is almost impossible to maintain a steady speed. This complicated the tests considerably.

B.H.P. As may be seen from the graph, power rises steeply with revs. between 5 and 6,000 r.p.m., after which a gradual flattening takes place culminating in maximum B.H.P. output at 7,000 r.p.m. The considerable figure of ·109 b.h.p. is achieved, which is extremely good for a 2 c.c. engine, and compares well with the few published figures for b.h.p. available for small diesels, which are, in our experience, usually exaggerated. Above 7,000 r.p.m. power falls off to ·08 b.h.p. at 10,000 r.p.m. This was the maximum speed at which engine was tested.

Static Thrust. The graph shows that using the maker's standard propeller, a maximum thrust of 17·6 ozs. was developed at 5,500 r.p.m. The particular engine tested would not run at higher speed with this load. It will be noted that static thrust falls quickly as r.p.m. decrease.

Tests were also made with an AEROMODELLER propeller specially designed for this engine. Maximum revs. attainable with this airscrew were 6,500, which reaches very nearly the maximum b.h.p. revs. Static thrust developed at this point is 18·7 ozs. It was not found possible to run the engine consistently at a speed below 5,000 r.p.m. with the AEROMODELLER propeller.



GENERAL AND CONSTRUCTIONAL DATA

Name. E.D. Competition Special.

Manufacturers' Name and Address. Electronic Developments (Surrey) Ltd., 18, Villiers Road, Kingston-on-Thames, Surrey. Tel.: Kingston 1223.

Retail Price. £4. 17s. 6d.

Delivery. 7 days.

Spares Service. Complete spares service direct from factory with 14 days delivery.

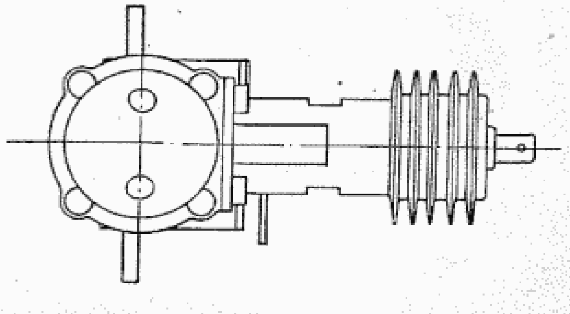
Type. Compression Ignition "Diesel."

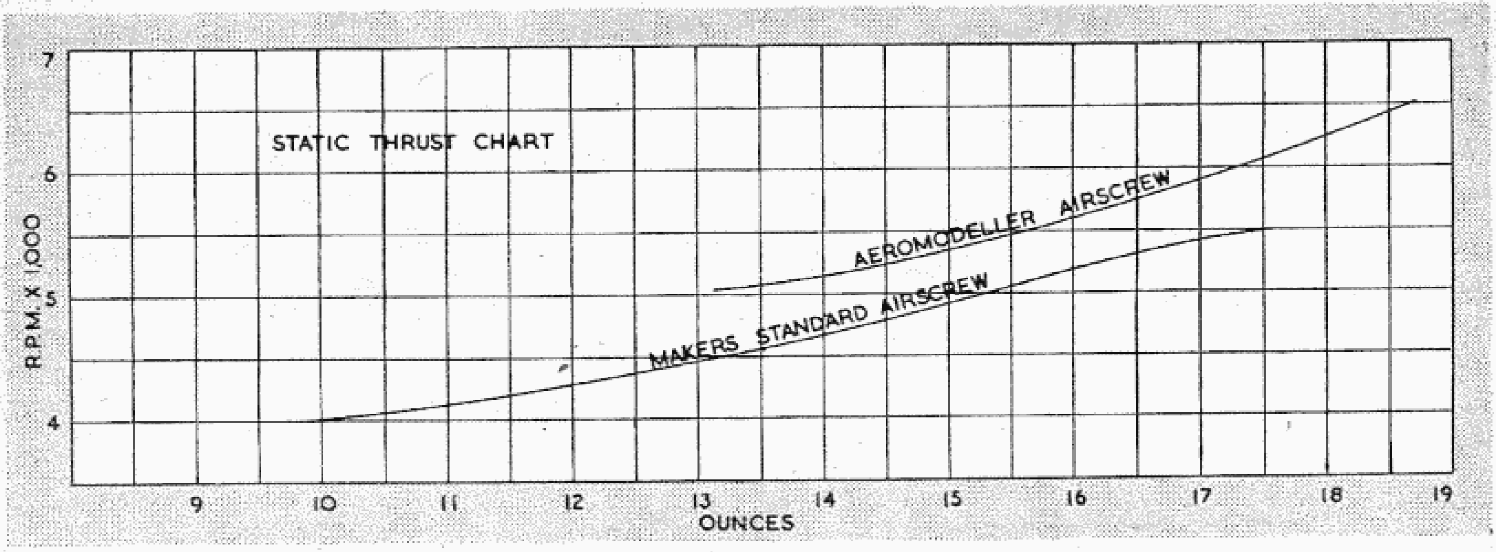
Specified Fuel. 1 part Ether Meth: 1 part Castor Oil: 1 part Paraffin Oil (Burning).

Capacity. 2 cubic centimetres: ·122 cubic inches.

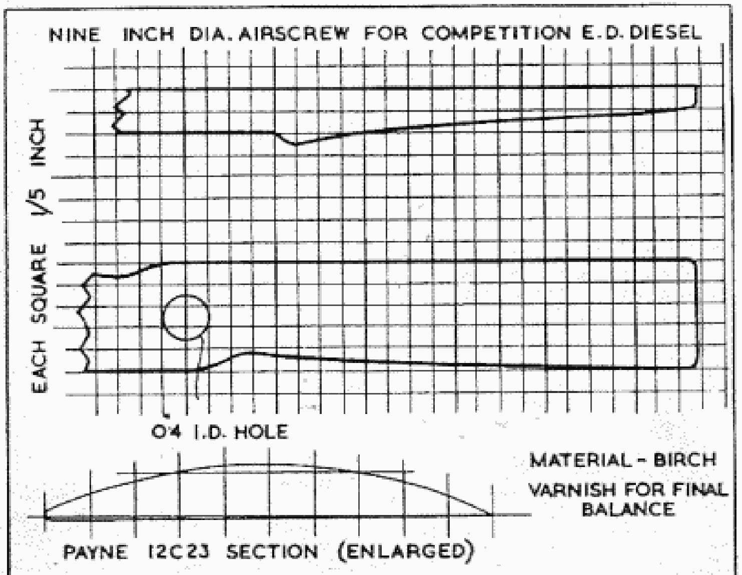
Weight. Bare 6 ozs. With 11 in. prop. 6½ ozs.

Compression Ratio. 16-1.



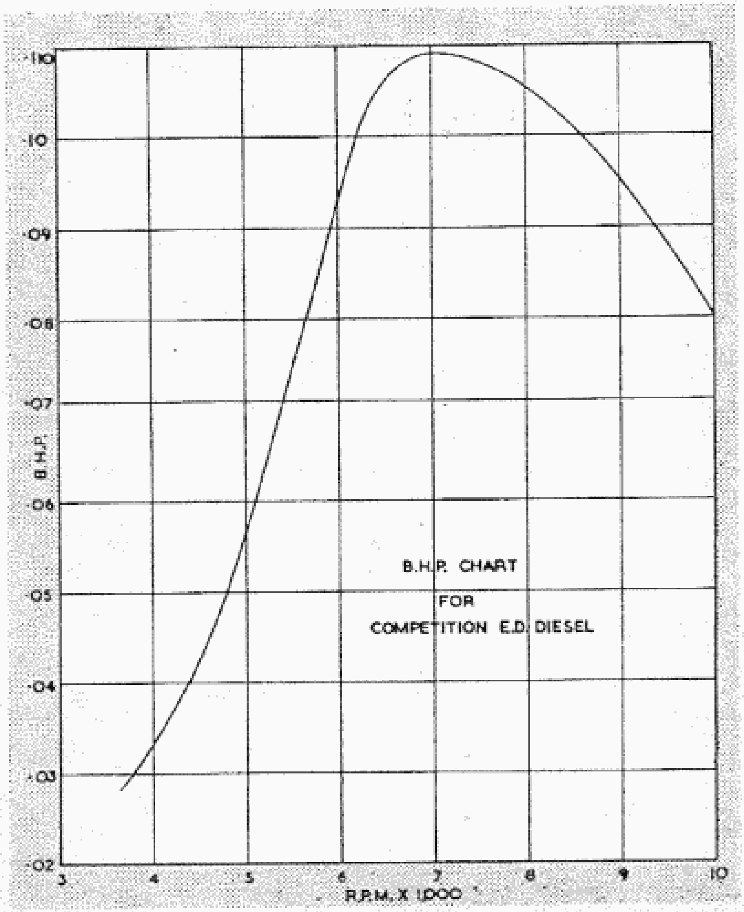


Mounting. Beam. Upright, or inverted.
Recommended Airscrew. Free flight 11 in. dia. 5 in. pitch. Control line 9 in. dia. 11 in. pitch.
Recommended Flywheel. 2 in. dia., weight 4½ ozs. Obtainable from manufacturers price 10s. 6d. with washer and Simmonds nut.
Tank. Plastic, capacity, 4 to 4½ minutes running time.
Bore. ½ in. **Stroke.** ⅝ in.
Cylinder. Hardened steel, ground and honed to accuracy of 0·0001 in. Ports: 2 exhausts, 1 induction, 2 transfer. The induction and transfer ports are soft soldered to the cylinder.
Cylinder Head. Duralumin with 5 cooling fins. Screwed on to cylinder with clearance for contra piston.
Contra Piston. Hardened steel, ground and honed to 0·0001 in. limits, adjusted by means of a Vernier Compression Screw.
Crankcase. L.33 alloy. Pressure die-cast and webbed to give maximum strength.
Piston. Cast iron, ground and honed to 0·0001 in. accuracy. Deflector milled to coincide with transfer port. No rings.
Connecting Rod. Hardened steel, bored and ground to 0·0001 in. limits.
Crankpin Bearing. Plain bearing machined from solid integral with crankshaft.
Crankshaft. Machined from S.14 hardened and ground to 0·0001 in. limits.
Main Bearing. Bearing housing made from L.33 material, pressure diecast, and bushed at each end with cast iron bushes, leaving 1/32 in. clearance between bushes. The bushes are ground to 0·0002 in. limits.
Special Features. Built in cut-out: Vernier compression adjustment: Specialised timing giving maximum possible power: Easily converted for inverted running by slackening carburettor locknut and reversing complete carburettor unit: Runs in either direction without affecting efficiency.



ORDINATES FOR PAYNE 12C23 SECTION

STATION	0	2	5	10	20	30	40	50	60	70	80	90	100
UPPER	0·3	2·1	3·6	5·7	8·5	10·3	11·8	12	11·4	10	8·0	4·9	0
LOWER	0·3	0·7	—	—	—	—	0·42	—	0·28	—	—	—	0



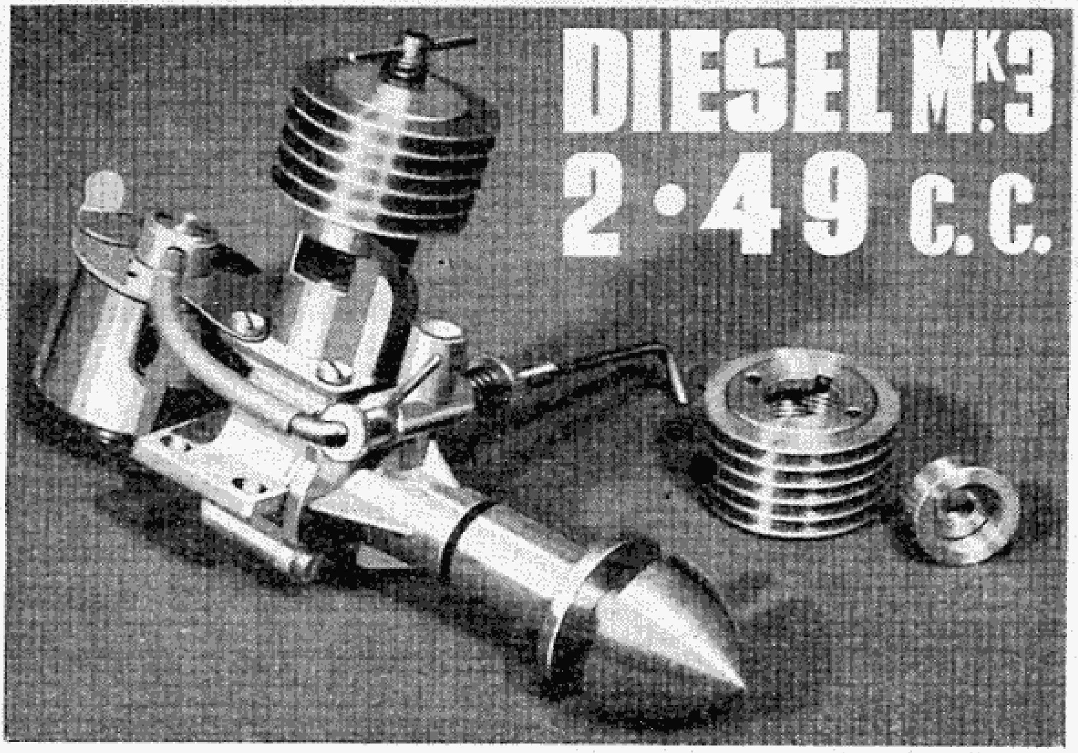
THE 'HOTTEST' ENGINES OF THEIR CLASS-

NOW THE AMAZING

E.D.

DIESEL Mk.3

2·49 c.c.



The Race-Car model which won the "M.G." Trophy at Eaton Bray on 28th March, 1948, was powered by the above unit.

SPECIALLY DESIGNED for "C" CLASS RACE-CARS and CONTROL LINE FLYING

Features

Rotary Valve, specially extended Prop-Hub (max. streamlining), additional conversion head for "Glo-Plug," every engine guaranteed. A speed of 41·5 m.p.h. has already been recorded in "C" class Race Car. Flexible throttle control. Double capacity Fuel Tank.

SPECIFICATION

Bore ·550 ins. Stroke ·625 ins.
Hole Centres for engine bearers $\frac{9}{16}$ in. × $1\frac{9}{16}$ in.
Cu. cap. 2·49 c.c. Static Thrust 30 ozs.
R.P.M. 8,500 (under load) Weight 6 ozs.
Height $3\frac{1}{4}$ ins. Width $1\frac{7}{8}$ ins.
Length 5 ins. (with extended prop. hub).
Prop. (U. Control) 9 ins. dia. 11 ins. pitch.
Prop. (Free flight) 11 ins. dia. 5 ins. pitch.
Prop. (Marine) $1\frac{3}{4}$ ins. dia. 5 ins. pitch.
Fuel 2 pts. Ether, 1 pt. Castor Oil,
1 pt. Paraffin Oil.
Compression Ratio Variable to infinity.
Rotation Clockwise and anti-clock.
Running Position Upright or inverted.
Controls, Needle valve & compression vernier.
Flywheel $4\frac{1}{2}$ ozs.
Also conversion Head for Glo-Plug

RECOMMENDED KITS

Keil Krafts—Slicker 42", Scout Bi-plane, etc.
H. J. Nicholls—Mercury Magnette, Alphacon, etc.
Southerns—Dragon, etc.
Dromes Club Kits, etc.
Ward & Wilkinsons—Whirlwind.
Normans—Special Kit, "The Minx."
etc., etc., etc.

PRICE £5.10.0

Complete with Conversion Head, at your nearest Model Shop.

E.D.

ELECTRONIC DEVELOPMENTS (SURREY) LTD.

DEVELOPMENT ENGINEERS

KINGSTON ON THAMES 1223.

18, VILLIERS ROAD, KINGSTON-ON-THAMES, SURREY, ENGLAND.


AMCO

87 MARK·I

.87 c.c DIESEL ENGINE WITH THE UNIQUE CUT-OUT

PROVISIONAL PATENT APPLICATION Nº 501-4

POWER—MINUS WEIGHT

WEIGHS UNDER 2 OZS

PRICE £4.4

COMPLETE WITH PROPELLER

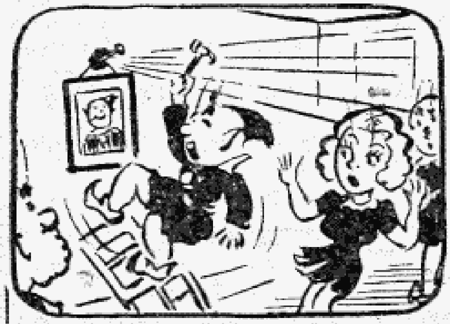
Now Available for AMCO

EXTENSION CARBURETTOR NEEDLE (adjustable for length) FOR CONTROL OF "COWLED" ENGINES.

2/6 each THROUGH ALL MODEL SHOPS

Supplied only through model shops

ANCHOR MOTOR CO·LTD·The NEWGATE·CHESTER


THE
"FLUXITE QUINS"
AT WORK.

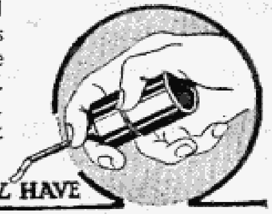
"This picture will certainly shake 'em
I surely just know how to take 'em"
Yelled EH "Yes, that's bright!
Now we'll need some FLUXITE
You're here to mend leaks not make 'em!"

★

See that FLUXITE is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for over 40 years in Government works and by leading Engineers and manufacturers.

OF ALL IRONMONGERS, IN TINS 10d., 1/6 & 3/-

TO CYCLISTS! Your wheels will not keep round and true unless the spokes are tied with fine wire at the crossing AND SOLDERED. This makes a much stronger wheel. It's simple with—FLUXITE—but IMPORTANT.


THE "FLUXITE GUN" puts FLUXITE where you want it by a simple pressure. **Price 1/6 or filled 2/6**

ALL MECHANICS *WILL* HAVE

FLUXITE

IT SIMPLIFIES *ALL* SOLDERING

Write for book on the Art of "SOFT" SOLDERING and for leaflet on CASE HARDENING STEEL and TEMPERING TOOLS with FLUXITE - - - - - - Price 1d. each.

FLUXITE LTD. (Dept. M.A.), Bermondsey St., S.E.1

The Future is YOURS
Prepare for it NOW

What about your future? What of the new great world of today? There are marvellous opportunities, but only for those who have had specialised training. One thing is certain—there is not, and never will be, a worth-while place for the untrained.

Ambitious men everywhere have succeeded through I.C.S. Home-Study Courses. So also can you. We offer you the benefit of our 56 years' matchless experience as creative pioneers of technical instruction by post.

Here are some of the subjects in which we offer thoroughly sound instruction:

ACCOUNTANCY
ADVERTISING
AERONAUTICAL ENG.
ARCHITECTURE
BOILERMAKING
BOOK-KEEPING
BUILDING
BUILDING SPECIF.
BUSINESS MANAGEMENT
CHEMISTRY, I. & O.
CIVIL ENGINEERING
CLERK OF WORKS
COAL MINING
COMMERCIAL ART
COMMERCIAL TRAINING
CONCRETE ENG.
DIESEL ENGINES
DRAUGHTSMANSHIP (State which branch)
DRAWING OFFICE PRAC.
ELECTRICAL ENG.
ELECTRIC POWER, LIGHTING TRANSMISSION, TRACTION
ENGINEER-IN-CHARGE
ENG. SHOP PRACTICE
FIRE ENGINEERING
FUEL TECHNOLOGY
HEATING & VENT.
HYDRAULIC ENG.
HYDRO-ELECTRIC
ILLUMINATION ENG.
INTERNAL COMB. ENG.
JOURNALISM
MACHINE DESIGNING
MACHINE-TOOL WORK
MARINE ENG.
MECHANICAL ENG.
MECH. DRAWING
MINING ELECTRICAL
MINING ENGINEERING
MOTOR ENGINEERING
MOTOR VEHICLE ELEC.
MOULDING
PLASTICS
PLUMBING
QUANTITY SURVEYING
RADIO ENGINEERING
RADIO SERVICE & SALES
REFRIGERATION
SALES MANAGEMENT
SANITARY ENG.
SCIENTIFIC M'G'MENT
SECRETARIAL WORK
SHEET METAL WORK
SHORT-STORY WRITING
STEAM ENGINEERING
STRUCTURAL STEELW'K
SURVEYING (State which branch)
TELEGRAPH ENG.
WELDING
WOODWORKING
WELDING, GAS & ELEC.
WORKS ENGINEERING
WORKS M'G'MENT

EXAMINATIONS: E.J.B.C. Prelim., I. Mech. E., I. Fire. E., B.Inst. Radio Eng., P.M.G. Wireless Operators, M.O.T. Certificates, I.Elec.E., C. & G. Elec., R.I.B.A., H.O. Mining, London Matric. and many Commercial Exams. ; also C.I.I. Elements of Nat. Insurance.

I.C.S. Examination Students coached until Successful.

Write to the I.C.S. Advisory Dept. stating your requirements. Our advice is free.

..............YOU MAY USE THIS COUPON..............

INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. 128, International Buildings, Kingsway, London, W.C.2
Please send me particulars of your Courses in

....

Name... Age............

Address...

....

Use penny stamp on unsealed envelope)

ICS

H. J. N. ADVOCATES

Progressive Modelling

"There's nothing I like better than selling good lines to people who appreciate them."
H.J.N.

An enthusiastic recruit to modelling, looking at our advertisements, accused us of having little or no time for the beginner, and said that we catered only for "power-hounds," experts, and R.A.F. "bods" on holiday! Yet this is far from being the whole story. It is true you will always find experienced modellers enjoying themselves at 308, but we never forget beginners. We do our utmost to put them on the right tracks from the word "go." That is why, this month, we have split our ad. into 3 sections, representing a fair example of a modeller's progress. **Whatever stage you have reached, you can depend on the H.J.N. organisation understanding your requirements completely.**


K.K. CO2

Group 'A'

FOR THE NEWCOMER

JETEX • RUBBER DURATION • KEILKRAFT C.O₂.

Halfax Tern Glider 40"	10/-
K.K. Soarer Baby Glider 36"	5/-
K.K. Soarer Minor Baby 48"	8/6
Halfax Minor (Rubber Powered) 24"	3/9
K.K. Orion (Rubber Powered 23"	3/6
K.K. Ajax (Rubber Powered) 30"	6/-
K.K. Playboy (Rubber Powered) 20"	3/3

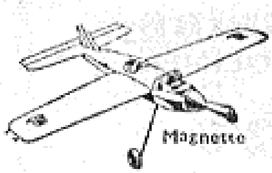
K.K. C.O.2 Engine	21/6
(Sparklet Units for above 6 for 3/-)	
K.K. Slicker Mite adapted for C.O.2	10/6
K.K. Skyjet 100—24" (for Jetex)	5/6
K.K. Skyjet 200—32" (for Jetex)	7/-
Veron Airojet (for Jetex 100) 30"	7/6
Veron Cirrojet (for Jetex 200) 35"	10/6
Jetex 100 Outfit 27/6 Jetex 200 Outfit	37/6

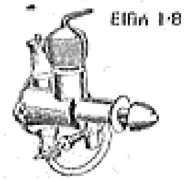
★ **BEGINNERS ARE URGED TO BUY PERSONALLY AS MUCH AS POSSIBLE**

Group 'B'

FOR INTERMEDIATE MODELLERS

POWERED FLYING—COMPETITION WORK


Magnette


Elfin 1·8

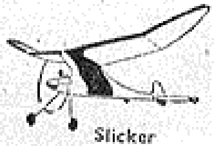
● KITS

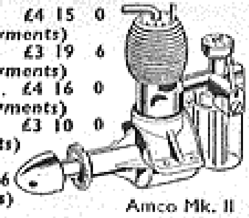
CONTROL LINE	
Mercury Magnette 26"	25/-
K.K. Stuntmaster 30"	19/6
Frog Vandiver 26"	13/6
J's Nancy 18"	14/6
K.K. Phantom 21"	18/6
Cessna Airmaster 25"	18/3
Megow Tyro Trainer	22/7
Modelair Nieuport 17c 20"	19/6
FREE FLIGHT	
K.K. Pirate 34"	13/6
K.K. Slicker 60"	47/6
K.K. Bandit 44"	21/-
K.K. Outlaw 50"	27/6
Precision Hammerhead 40"	19/6
Frog Venus (Rubber) 36"	15/-
Halfax Rapier 48"	22/6
Halfax Spartan 60"	45/-

● ENGINES

(Prices subject to alteration without notice.)

E.D. Mk. I (Bee)	£2 5 0
Amco Mk. II ·87 c.c. *(or by monthly payments)*	£3 12 6
Mills Mk. II. 1·3 c.c. *(or by monthly payments)*	£4 15 0
Elfin 1·8 c.c. *(or by monthly payments)*	£3 19 6
Allbon Mk. II. 2·8 c.c. *(or by monthly payments)*	£4 16 0
E.D. Mk. II. 2 c.c. *(or by monthly payments)*	£3 10 0
E.D. Comp. Spec. 2 c.c. *(or by monthly payments)*	£3 17 6


Slicker


Amco Mk. II

★ **ENGINES COSTING 70/- OR MORE AVAILABLE BY MONTHLY PAYMENTS**

Group 'C'

FOR ADVANCED MODELLERS

RADIO-CONTROL ● FREE LANCE DESIGN ● EXPERIMENTAL WORK

Mercury Radio-Control

FOR DELIVERY NOW

Gives 3 controls over a single channel. **No special knowledge needed to instal and operate.** Actuator may be used to advantage with any sequential R/C system. This equipment is as light and dependable as the best practice in radio can make it. S.A.E. for leaflet.

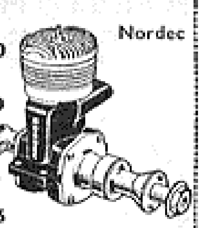
COMPLETE OUTFIT	**12½ Gns.**
Transmitter	**£7 12 0**
Receiver	**£2 16 0**
Actuator *(Prov. Pat.)*	**£2 16 6**

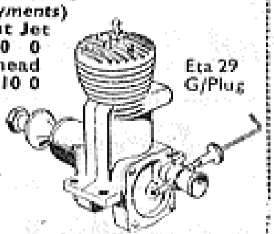
● Kits

K.K. Falcon *For Radio Control. (Available by monthly payments)*	**£5 17 6**
Veron Stentorian *(For Radio Control)*	**69/6**
Veron Hawker Sea-Fury X *(The C/L sensation)*	**22/6**
Halfax Jaguar *(1948 Wakefield Winner)*	**21/-**
Albatross II 94" *(The Glider for Experts)*	**36/-**
Cocks Kan-Doo C/L *(Gold Trophy Winner)*	**25/-**
Megow Competitor C/L 26½"	**34/9**

● Engines

Nordec 10 c.c. G/Plug *(or by monthly payments)*	**£12 0 0**
Nordec 10 c.c. Petrol *(or by monthly payments)*	**£12 10 0**
★Eta 29 5 c.c. G/Plug *(or by monthly payments)*	**£5 19 6**
Mills 2·4 c.c. Diesel *(or by monthly payments)*	**£5 17 6**
Jaggers Juggernaut Jet	**£6 10 0**
Jaggers Red-head	**£8 10 0**


Nordec


Eta 29 G/Plug

★IT'S ALL IN EASY-REF. LIST No. 3 (with latest supplement)

No More Engine Worries

We have the only trained staff and specially equipped workshop in the country devoted exclusively to repairs, test and service. You can depend on the engine you send us coming back to you 100% right. Test certificate and running instructions with every job.
It is regretted that we can no longer service FROG engines.

HOW TO ORDER

Send cash, cheque or money order with order, or pay the postman. Orders over £1 post free; under, send 1/- postage for kits, 6d. for accessories, unless stated.

MONTHLY PAYMENTS

Engines over 70/-, certain kits and other lines where indicated may be purchased by monthly payments. Send S.A.E for details.

Accessories for all stages of modelling

When ordering, it will help if (1) Where possible you mention an alternative for props. (2) Order as much as possible at the same time. This saves you time, money and unnecessary delay.

● CONTROL - LINE

Ajustalyne C/L Handle	7/6
Mercury Plastic Bell Cranks	4½d. and 6½d.
Snip Speed Chart	2/6
Bat small stunt tank	5/-
Bat large stunt tank	6/6
Mercury Control Wire 200 ft.	2/-

● POWER MODEL

Mercury Fuel Funnel	4/3
Mercury Fuel Filter	2/3
Mercury Plug Protector	2/3
Dekko Rev. Counter	10/-
Britfix Balsa Cement	per tube 7d.
Mercury Cement Nozzle	10d.
Cockpit Covers 4" long	9d.
Solarbo Balsa (Min. Mail Order)	10/6
Dunlop Rubber.	

● EASY - REF. LIST No. 3 AND FEB. SUPPLEMENT

Combined with this advertisement, Easy-reference List No. 3 and the Feb. supplement provide the most up-to-date and detailed information any modeller could wish for. Send for list and/or supplement without delay.

SPECIAL NOTICE

All engines, and certain accessories are subject to alteration in price without notice in the event of Purchase Tax becoming chargeable. We shall make no change, however, in the minimum price at which engines may be purchased by monthly payments i.e. 70/-

HENRY J. NICHOLLS LTD.
308, HOLLOWAY ROAD, LONDON, N.7
Telephone NORth 5181 • OPEN ALL DAY SATURDAY • Two minutes from Holloway Road Und.

MILLS diesel design

This series of articles spotlights features and details of design marking the superiority of Mills Diesels.

3. CYLINDER STEEL

The cylinder is the most vital single component of a "Diesel", if alone for the fact that on its fitness depends the engine's useful span of life. The choice of material for the cylinder can therefore make or mar an engine.

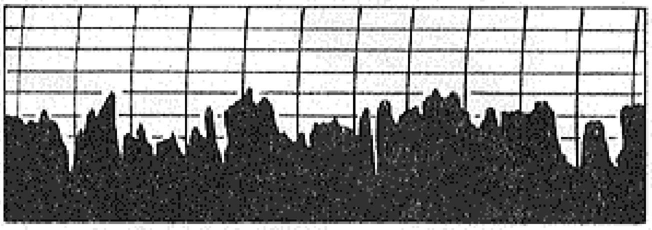
Mills set the standard of performance and engine life by making the cylinder of Firth Brown Nitralloy HCM 7 Steel, a Chromium-Molybdenum steel of admirably suited virtues.

★ HCM 7 hones to the fine "dull grey" finish which is perfect for ideal smoothness and effective oil retention. *These properties are essential for high performance.*

★ The wearing quality of this tough-cored and hard-surfaced steel (830 Diamond Hardness) makes an engine life of 400 hours a reasonable expectation. *This life has been proved in practice over and over again and makes a "Mills" one of the cheapest power units.*

★ The nitrided case retains its hardness up to a temperature of 500°C. This is a great advantage over other surfaced hardened steels which begin to soften at 200°C. *Thus in the event of overheating owing to faulty lubrication, there is considerably less risk of engine seizure.*

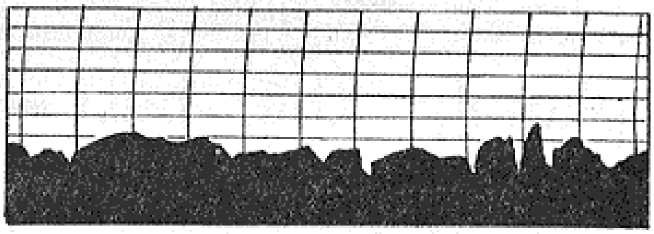
★ In its nitrided condition the steel resists the corrosive action of fresh water, sea water, steam and moist atmosphere. *In practice this means that your "Mills" is not a fussy engine; it withstands severe climatic conditions and needs little attention in every day use.*



PORTRAIT OF A "MIRROR" FINISH

(Magnified vertically 40,000X, and horizontally 50X.)

Section of a Mills 1·3 c.c. Cylinder after honing (above) and the Cylinder Wall after initial running-in (below). The average surface finish of the latter was 2·4 mu. inches; the average finish of the cylinder wall between ports and TDC was 1·83 mu. inches (less than 2 millionths of an inch).



Footnote: Though to the naked eye a cylinder may appear to have "mirror" finish, modern laboratory equipment reveals mercilessly the slightest unevenness, by using suitable distorting degrees of magnification.

Incidentally, the piston and cylinder do not touch each other. They are separated by a film of oil. At the same scale of magnification and the normal Mills piston clearance of ·000075", this film of oil would measure 3 inches in thickness, and the piston belonging to the cylinder wall in the lower illustration would be found to be floating somewhere at the level of the outlined word "MILLS" in the heading of this advertisement.

Mills Diesel engines are designed throughout on scientific principles proved in experimental research, and all materials are selected without compromise for suitability and quality to give lasting life to engines of superior design.

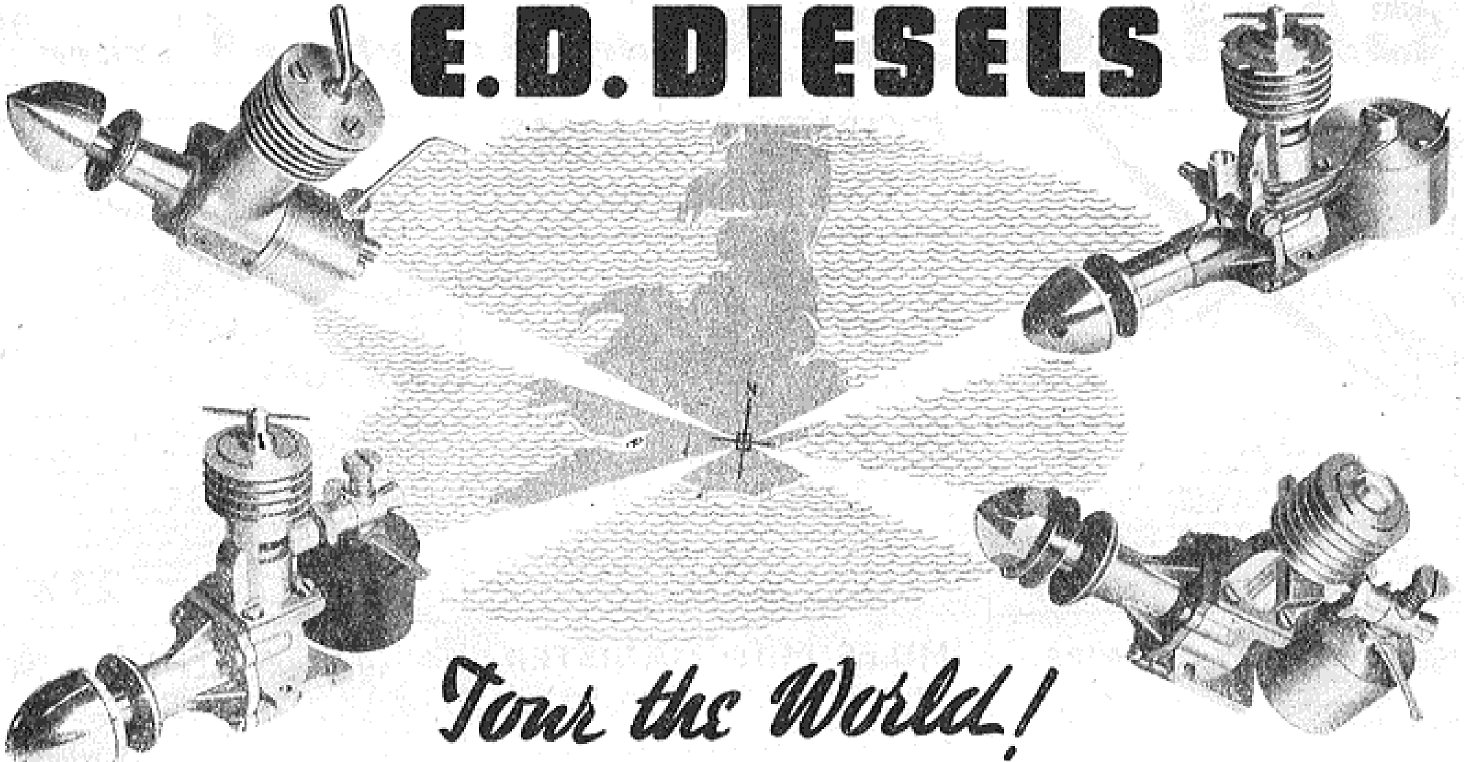
·75 c.c.	10 ozs. Thrust, 2 ozs. Weight, Max. Power at 9,000 RPM	**£3 . 5 . 0**
1·3 c.c.	18 ozs. Thrust, 3½ ozs. Weight, Max. Power at 10,000 RPM	**£4 . 15 . 0**
2·4 c.c.	32 ozs. Thrust, 6 ozs. Weight, Max. Power at 9,500 RPM	**£5 . 10 . 0**
1·3 c.c.	Marine Unit complete with Flywheel and Exhaust Stubs	**£5 . 5 . 0**

USE MILLS BLUE LABEL DIESEL FUEL IN THE **10 oz.** CONTAINER, **Price 2/6**

Wholesale Distributors in the U.K.: E. KEIL & CO. LTD., LONDON, E.2

MILLS BROS (MODEL ENGINEERS) LTD.
2 VICTORIA COLONNADE · SOUTHAMPTON ROW · LONDON · W.C.I

E.D. DIESELS



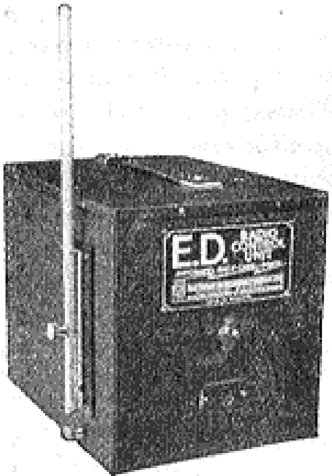
Tour the World!

World tourists—first class! Apart from the tremendous demand at home (and it is no exaggeration to say that the majority of British Model enthusiasts choose E.D.'s), the continuous flow of orders from overseas fill the E.D. factory to capacity. For many months, day and night shifts have been in operation at the E.D. works. *There must be a reason.*

1 c.c. MARK I BEE (the engine with a sting)	£2 5 0
2 c.c. MARK II, excels with marine models	£3 10 0
2 c.c. COMPETITION SPECIAL, Record Holder control line, 89·95 m.p.h.	£3 17 6
2·49 c.c. MARK III, Record Holder "C" Cars, 50·5 m.p.h.	£4 5 0

Do not order direct, order from your nearest Model Shop.

E.D. RADIO CONTROL UNIT



The Transmitter

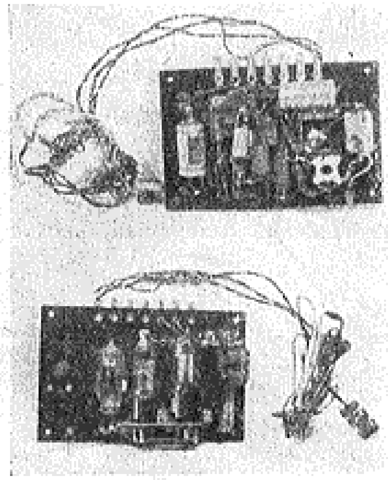
Surpasses any known apparatus on the market for reliability, efficiency, design and price. Provides the answer to the ever-growing demand for reliable control at long range. Simplicity itself—no technical knowledge required. Guaranteed range of control is 1,000 yards, but under test and severe conditions craft has been controlled at much longer ranges.

Unit comprises two-valve battery-operated Transmitter size 8" high, 7" wide, 9¾" deep, a three-valve circuit Receiver with single tuning control and a clockwork Servo.

The complete set is of compact design and minimum weight consistent with mechanical and electrical reliability. Complete unit, less batteries, **£14 10 0.**

Wooden Box returnable 5/-

Ask for descriptive literature from your nearest Model Shop or write to the makers.



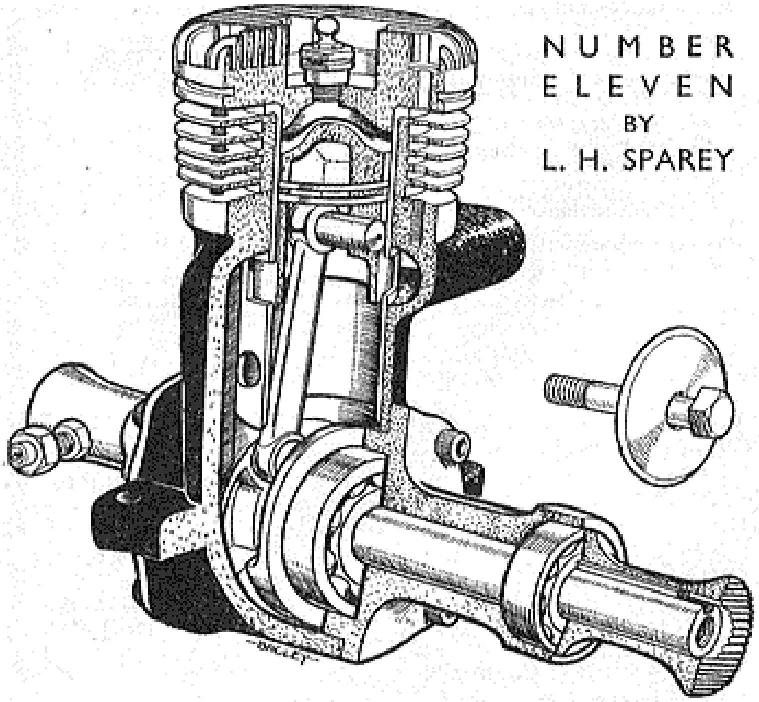
Two views of the Receiver

E.D. ELECTRONIC DEVELOPMENTS (SURREY) LTD.

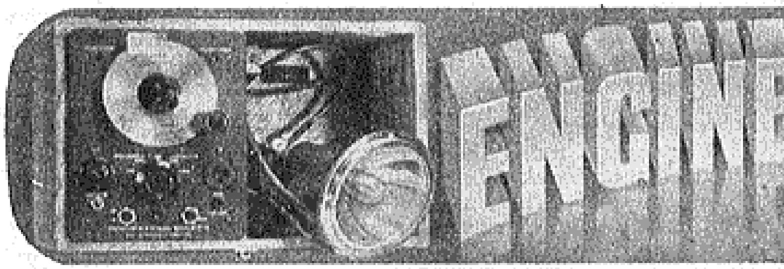
KINGSTON ON THAMES

DEVELOPMENT ENGINEERS

1223. 18, VILLIERS ROAD, KINGSTON-ON-THAMES, SURREY, ENGLAND.



NUMBER
ELEVEN
BY
L. H. SPAREY



THE NORDEC R.G. 10. RACING ENGINE

ALTHOUGH I have several glowplug versions of standard engines awaiting tests, this month's report deals with the first test to be published in these columns of a glowplug engine. The Nordec 10 c.c. engine is the largest yet handled, and the tests were carried out with considerable interest.

As it was anticipated that the Nordec engine would deliver considerably greater power than has yet been handled, the Torque Reaction Balance used for the tests was considerably strengthened, and certain parts re-designed to withstand anticipated strains. It will be appreciated that considerable stress is imposed on any engine mount when a large engine such as this is running "flat-out".

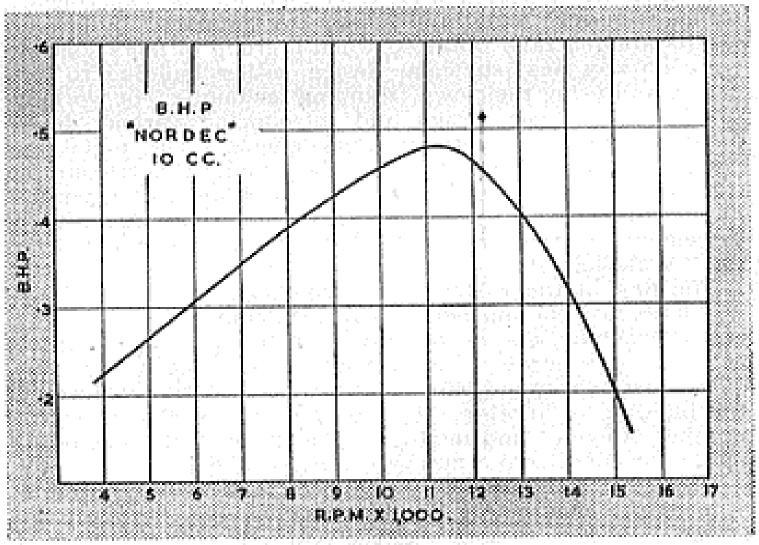
TEST

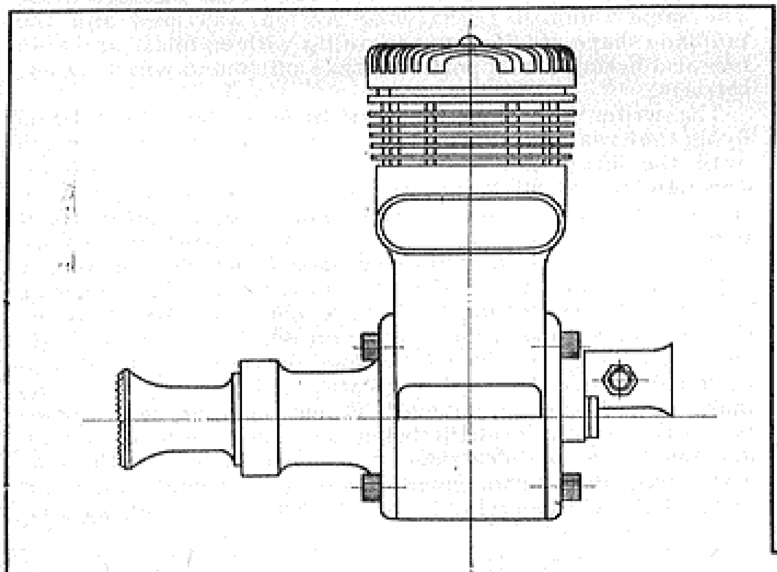
Engine : Nordec, 10 c.c. Glowplug ignition.

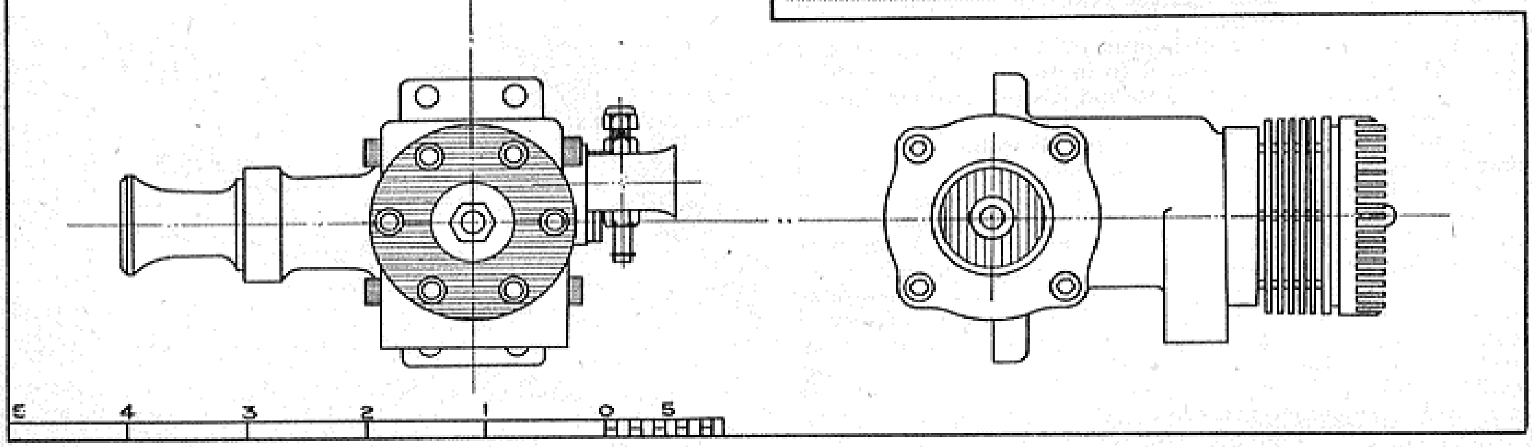
Fuel : "Rev" fuel, as supplied by engine makers.

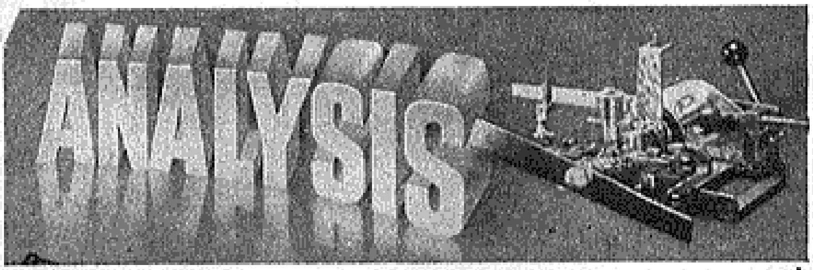
Starting : Although, for convenience, pulley and cord starting was generally used in the tests, the engine was experimentally started several times by hand. Starting under all conditions was exceptionally easy, and once the carburetter control was mastered the engine never once failed to respond. As no tank is supplied by the makers, a gravity feed tank was used, as the position of the carbuetter seemed to indicate that this method of feed would be most suitable.

Running : The Nordec was one of the most pleasant engines









that I have yet handled, being free from all fussiness, and maintaining even speed over a very large range of r.p.m. Carburetter control was smooth and certain, and the engine responded well to adjustments. Long, steady runs were possible over the whole speed range, although, at the higher speeds, around 15,000 r.p.m., the fuel tank was emptied at an alarming rate—about 2 ozs. fuel per minute. No cut-out is provided on the engine.

B.H.P. : It was expected that a high power output would be developed, and, as may be seen from the curve, expectations were fulfilled.

First test was made at a speed of 3,800 r.p.m. and a result of ·213 b.h.p. was attained. Tests were continued at increasing speeds, until a maximum output of ·480 b.h.p. was reached at a speed of 11,200 r.p.m. Further increases of speed yielded decreasing output figures, until, at 15,000 r.p.m. output was down to .200 b.h.p. Although the engine expressed willingness to revolve even faster, tests were discontinued at 15,000 r.p.m.

Power/Weight Ratio : ·480 b.h.p. per lb.

Remarks : The power developed by small internal combustion engines is always, to my mind, remarkable, and it makes food for thought that almost ½ b.h.p. can be developed by a small engine that can easily be held in the hand. The performance of the Nordec, while in line with that of engines of other capacities, may be considered excellent, if not remarkable. Internal constructional features of the engine seem well designed to cope with the power developed, and it can be truthfully stated that the engine, after two days of hard work under exacting conditions, seemed none the worse for the experience.

GENERAL CONSTRUCTIONAL DATA

Name : Nordec R.G.10.
Manufacturer : North Downs Engineering Co., Godstone Road, Whyteleafe, Surrey.
Retail Price : £12 0s. 0d.
Delivery : Ex-stock.
Spares : Ex-stock all parts.
Type : Glo-plug.
Specified Fuel : 3 parts Methanol/1 Part Castor Oil.
Capacity: 0·60 cubic ins. 9·98 c.cms.
Weight : Bare 16 ozs.
Compression Ratio : 10 : 1.
Mounting : Beam, upright and inverted.
Recommended Airscrew : Running in 12 × 12 ins. Sport 10 × 10 ins. Speed 9 × 10 ins.
Recommended Flywheel : 6 to 7 ozs.
Tank : No tank supplied.
Bore : 0·940 ins. **Stroke :** 0.875 ins.
Cylinder : Meehanite, attached by six 4 B.A. cap head Allen screws 1 inch long. 2 ports.
Cylinder Head : D.T.D. 255 attached by six 4 B.A. cap head Allen screws 1 inch long.
Cylinder Liner : Meehanite.
Crankcase : D.T.D. 424 sand casting.
Piston : D.T.D. 287 diecasting with deflection top and two rings.
Connecting Rod : 2–L–40 drop forged.
Crankpin Bearing : Bushed phosphor bronze.
Crankshaft : 3 per cent. nickel steel, case hardened and ground.
Main Bearing : 2 cage type ballraces.
Little End Bearing : Plain 2–L–40.
Crankshaft Valve : Disc type D.T.D. 424.
Plug : ¼ in. × 40 T.P.I., K.L.G.

Wakefield Models *(continued)*

Six Wakefields were laid down towards the end of 1947, of which one was a streamliner with the same wings, tail and propeller unit. Two streamlined-slabsiders only were finished at the time, basically as 1947 layout with slightly longer fuselage again, Joukowski wing section and one with mono-wheel and one with twin-wheel undercarriages.

There was little to choose between them. Both trimmed up to the 4 minutes 45 seconds mark on 1,000 turns and both had an excellent glide. The mono-wheel version was lost test flying just before the first Wakefield trials ; the other flew away on the last flight in these trials. Only the former was ever recovered and that so badly damaged that it was written off as a contest model.

The wings from this went back on to the original 1947 job, which immediately began to perform like the later models ! Another twin-leg version was completed from the original line and trimmed for the "Wakefield 100." The weather was so atrocious between then and the contest day that trimming was rather incomplete—and a check flight early in the morning on the day in question resulted in the job flying away. Hence for the Trials only the 1947 job (with 1948 wings) was left.

This, too, as recorded, flew away on its first flight—the worst feature from the writer's point of view being that it came down on the D/T chute all right, but in such an area that it was quite impossible to locate it. It was a job which, trimmed as a reserve machine, had a performance very nearly equal to that of the original contest machines.

The streamliner did not, on the whole, compare favourably with the streamliner-slabsider series. It was certainly inferior as regards climb and certainly no better on the glide. But it never received quite the same attention as regards trimming as the others at the beginning of the season.

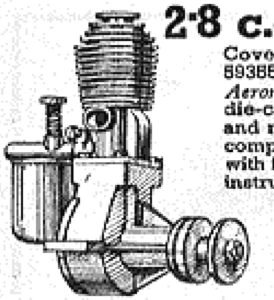
Structurally the streamlined-slabsider layout now seems standardised. Built right down to weight, the fuselage has a weak point just in front of the wing box. This is only apparent in very bad landings—*e.g.*, flying into a house at the end of the flight, but in most cases the models recovered after fly-aways suffered in this respect. This is a point which will receive attention by the addition of local bracing (*i.e.*, a false longeron running inside the main longeron in this region).

Aerodynamically, the design can only be cleared up in the region of the nose and the present method of construction (sheet balsa super-stringers) will probably be abandoned in favour of more stringers of smaller cross section. Nose entry will be improved by lengthening the spinner and enclosing the whole of the freewheel unit and winding loop inside the front of the spinner (see Fig. 8). Nose entry is very important as far as drag reduction goes—the drag of an unfinished spinner of, say, 1¾ ins. diameter, probably being higher than that of the rest of the fuselage.

The only other way to reduce drag would be to modify the fuselage shape. In view of the comparable performance of the streamliner it appears very doubtful that the circular section has any less drag than that of the present form. This leaves only reduction in wetted area as a source of potential improvement.

This has been tackled in the manner shown in Fig. 9, which at present is being flight tested alongside a model to the standard layout. The same basic proportions of the original fuselage are retained, but both wing and chute boxes are taken outside the lines of the fuselage proper. This gives exactly the same rubber clearance as with the standard layout with a reduction in structural weight and considerable reduction in wetted area. The spinner length is even more exaggerated to fit in with the slimmer nose lines.

It now remains to be proved whether or not the form drag of the two bubble fairings is appreciable or, in other words, whether a saving in overall drag has, in fact, been made. If satisfactory, it is intended to develop this model with a folding-freewheeling propeller (*i.e.*, one propeller which can be used either as a folder or freewheeler as conditions demand) and retractable undercarriage, which then represents about the aerodynamic limit to which the streamlined-slabsider can be taken.



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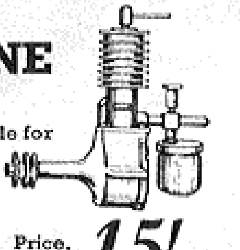

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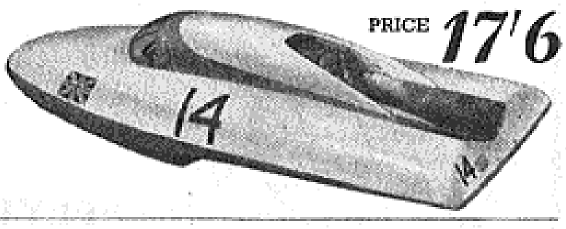

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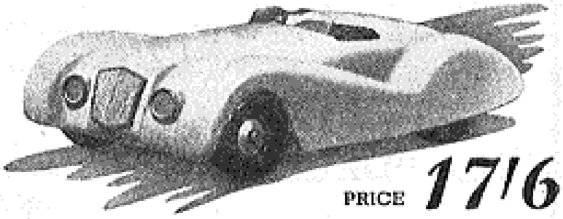

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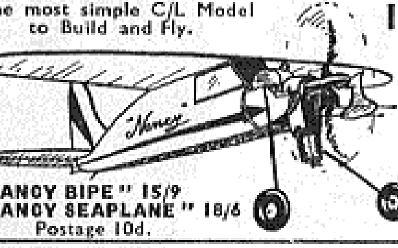

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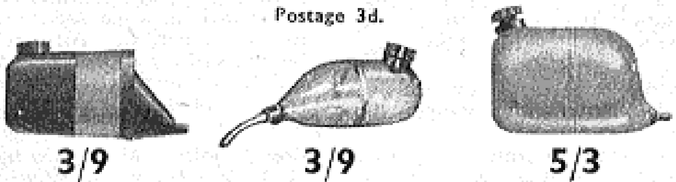

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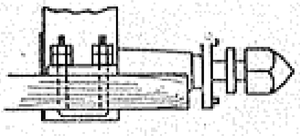

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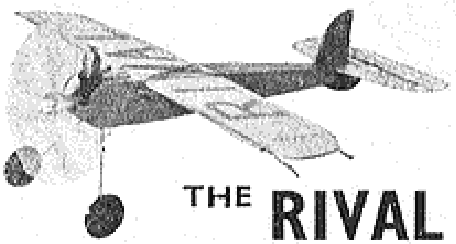

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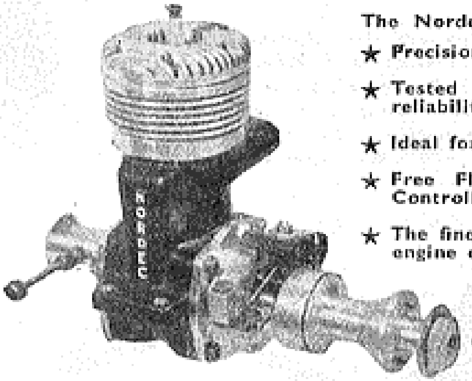

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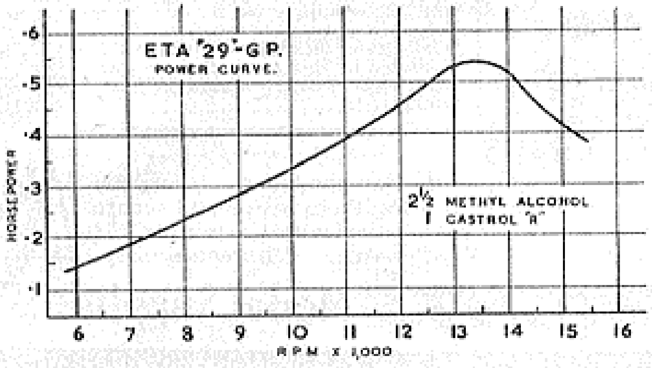

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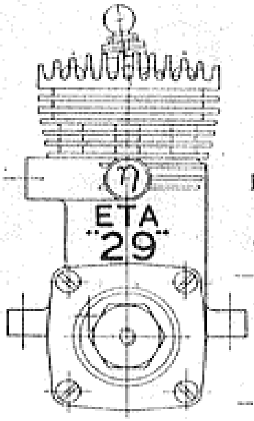

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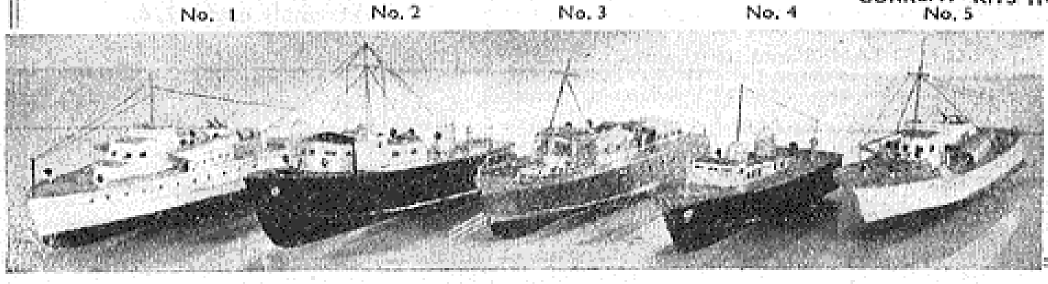

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Constant striving for perfection calls for exhaustive research into the behaviour of each component. Here depicted is a critical examination of a crankshaft of the new 2·4 c.c. Mills Diesel.

A shaft, picked at random, was submitted to specialised tests to ascertain its actual strength at the points most highly stressed. These points are the crankpin which has to transmit the power of each explosion, and the mainbearing just behind the driving disc which may have to bear the full brunt of crash landings.

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Bend Test: A variable load was then applied to represent the impact of crash landings. After increasing this load to 500 lb. ins., the shaft only bent to an angle of 13 minutes, *i.e.* less than ¼ degree. Although this imperceptible bend is measurable under test conditions, it would not interfere with the usefulness of the shaft in service.

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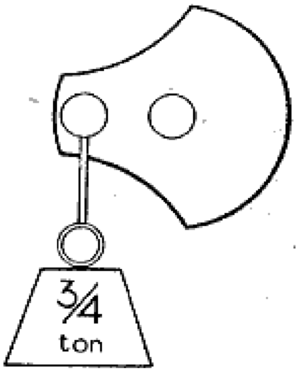
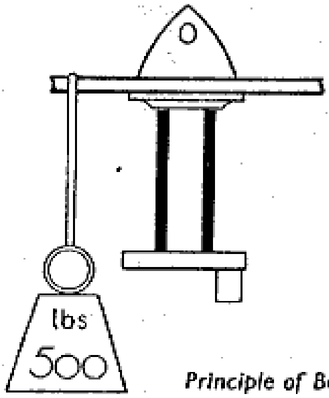
Principle of Torque Test.





Principle of Bend Test.

Unretouched photo of shaft after test.

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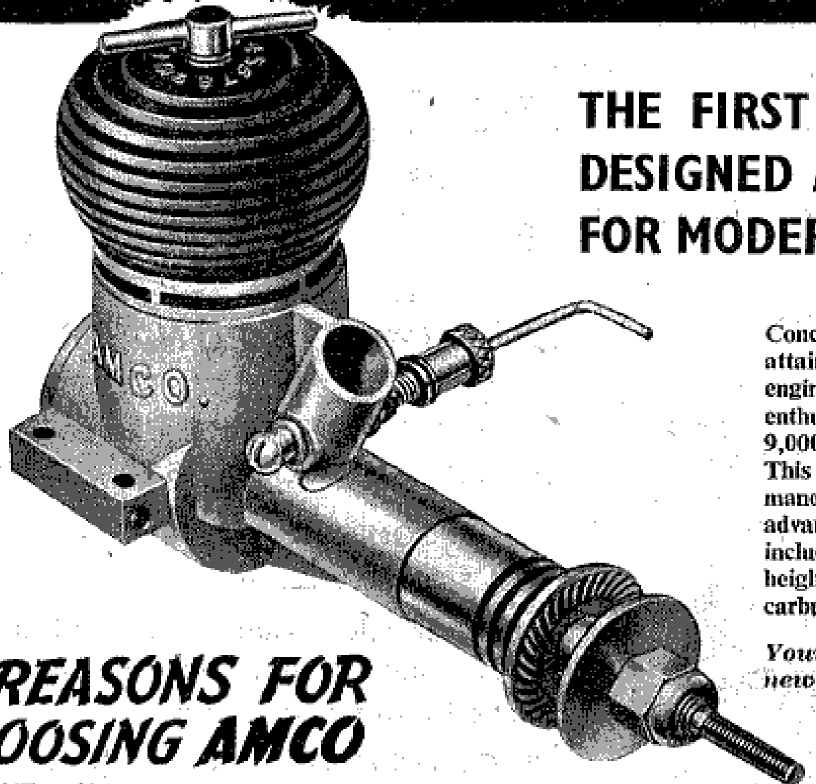

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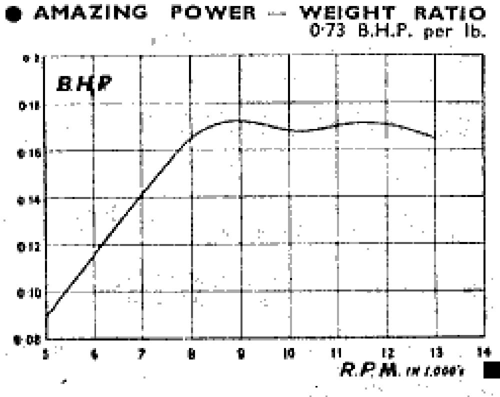

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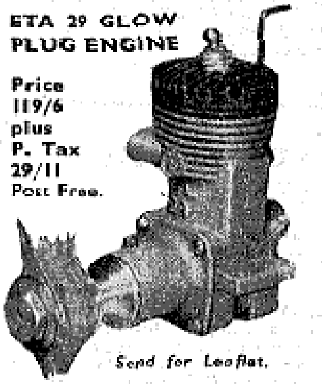

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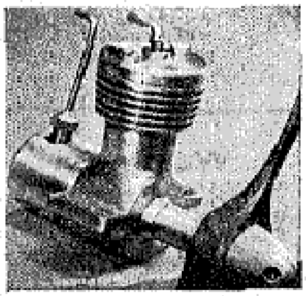

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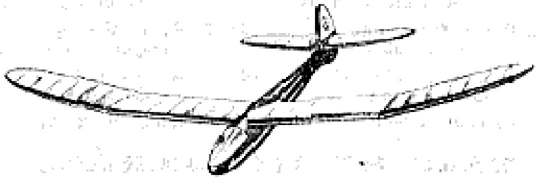

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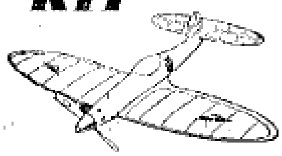

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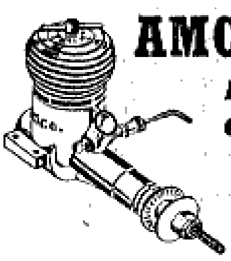

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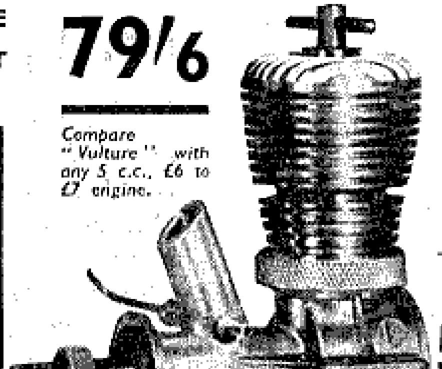

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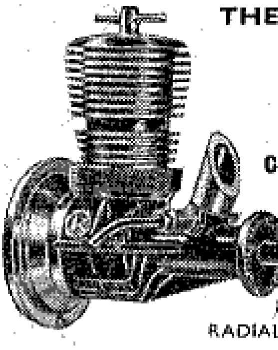

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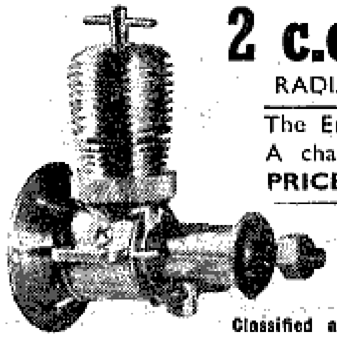

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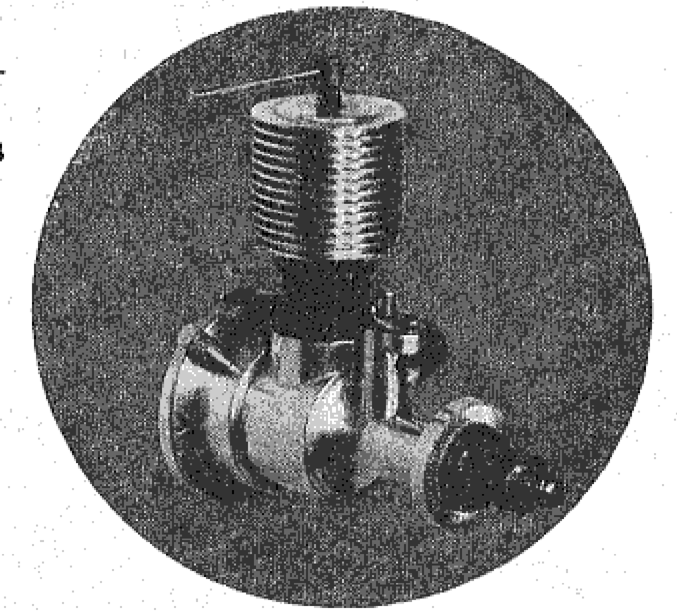


IN the past two years I have had quite a number of model diesels brought to me which were troubling their owners. There have been no less than 14 different makes, in all states of sickness and of health; and for that matter some were nearly at the "death do us part" stage. All this experience has resulted in a private system of my own for finding the troubles, or if there is nothing wrong for deciding the best running settings. It might interest you, so here it is.

Take the dry engine, and turn it over in your hand, to see that the two pistons are not touching, and to feel the compression. Set the maker's instructions and try to start. If the engine fails to start adjust the contra piston until it touches the piston, then slack back the lever 1½–2 turns.

Then mount the engine upright and *without* filling the tank introduce two or three drops only of fuel into the exhaust ports, slowly turn the engine over holding prop firmly and flick to start. If the engine hydraulics clean in usual fashion and prime with less fuel. If the compression is right you get a short burst ending in an abrupt cut out as the fuel is used up. Memorise that sound, as a similar cut-off later shows shortage of fuel (or sometimes not enough compression) as explained later.

Oscillation of the airscrew or a start followed by a rapid slowing down of the airscrew to a stop, together with knocking or a harsh metallic note, shows the exact reverse.

If the engine does not fire you can usually tell by the feel of the flick whether to give more compression or by the feel of your finger whether to give less! More is usually the requirement, and repeating the primary start idea, soon gives you the right compression. Never overdo the priming or a false impression of over-compression will result. Do this a few more times, and the engine will warm up, when it may be found that a little less compression is called for.

Now all that is required is to allow enough fuel feed for the normal feed to take over as the "priming start" tapers off. Take out the needle and look at it. If it has a coarse taper, like a knitting needle, it will need to be open about half a turn from the off position. If very fine like a small sewing needle the amount of adjustment might be as much as three turns. Fill the tank, and set the needle to a little less than the guessed setting for running, and repeat the "priming start" *without* choking or sucking in fuel. The normal short burst will result with possibly a slightly longer period. Try again, with a shade more opening of fuel control, and soon you will find a position where the normal fuel supply will take over from the primer and the engine will continue to run. I have had an unknown make of engine running in under a minute from first trial.

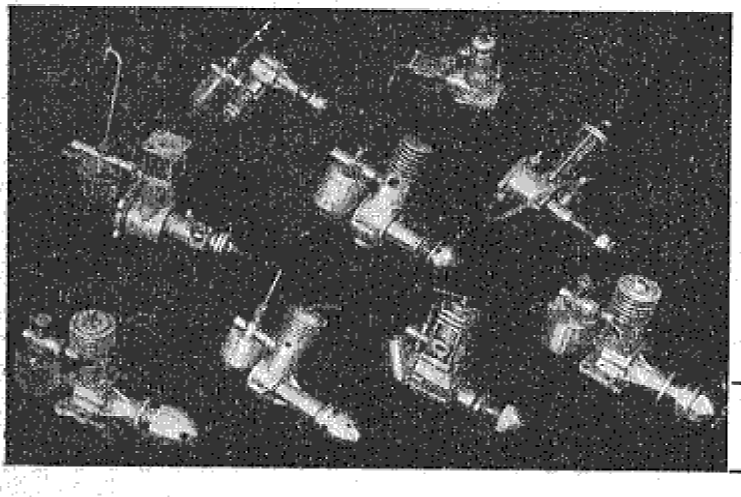
Once running and the engine warmed up, listen to the engine note and look at the exhaust for excess smoke or unburnt fuel in considerable quantities, indicating that the fuel is too rich and the needle must be screwed in a little. It may happen that despite the above faults the engine runs fast with a healthy crackle and when the fuel is reduced it stops. The explanation is that an excess of fuel was partly filling the combustion space artificially increasing the compression. When the fuel is reduced this compression drops and stops the engine. The remedy is to increase compression by the control *first* then reduce fuel, which should give more power.

Some engines require a reduction of compression as they warm up, whilst a few are still more awkward. One of mine on starting requires an increase of compression and reduction of fuel, then it runs fast and becomes very warm, I then have to reduce compression again, and the power goes right up. Nothing will make this engine pick up from start if you merely alter the fuel to full power position, although the starting and final running compression settings are the same.

It follows that once you have worked through the "priming start" and found a fuel position which will allow continued running you must try various adjustments until full power is obtained and then note the positions of the controls. Once found these will not alter unless your fuel is varied, and you now direct your work to finding the normal "choke and suck start" position. To do this you simply have to substitute the fuel introduced by sucking in for the fuel introduced by priming in the first method. Open the needle a bit from running position and try it. Normally you have to double the amount of turn from "off" position, compared with the final running position just established. That is, if the engine gives full power at ¾ of a turn from "off", try 1½ turns for a suck engine, but only suck in once or twice or you will flood the engine. You will also have to put the compression back to the "cold" position, reversing the alteration required to obtain full power.

In all the above, you should use a standard commercial fuel with its ordinary ether allowance freshly mixed. Some small engines will be found to have very small exhaust slots, and in that case a hypodermic needle is a great help. Naturally when handling the small engines you insert less fuel than you would in the case of a 5 c.c. job.

So far we have assumed that the engine is all right and that if given fuel and the right treatment, it will run. But there comes a time when the engine is not all right. To guide you in this the following notes are offered as assistance.



Starting such a varied collection of engines as this would present a very difficult problem to the inexperienced without the fool-proof system outlined by the author in this article.

1. Unless there is something wrong with the mechanical parts the engine will run when "prime started". The only three cases which would not were found to have something wrong internally. One had no compression; the piston and cylinder were worn out! It was finally made to give short runs by liberal use of heavy oil before starting and by using extra ether in the fuel.

Another was a great puzzle until the owner admitted having taken it down, when on dismantling it was seen that he had put the piston back the wrong way round. The step cut to open the transfer ports was thus at the wrong side and there was no transfer passage at all. A third was found to have its crankshaft (which was hollow for the usual ported crankshaft) all filled up with a white gum. It was found that the owner had used a length of wireless set insulation tube as a fuel pipe, and the ether had dissolved the covering which had baked into the inside of the engine.

2. Sometimes there is a click noise and the engine will not run. This is due to the propeller not being tight, and when the engine goes over top centre it lashes over through the play allowed, either between a square on the shaft and the prop washer, or at the driving pegs in the airscrew. Another variation of this is that some small engines with light wooden props are hard to flick fast enough, there being insufficient flywheel effect at slow speeds. Young modellers who have not yet attained strong wrists find this class difficult, but if a plastic prop is used this is often enough to cure the trouble.

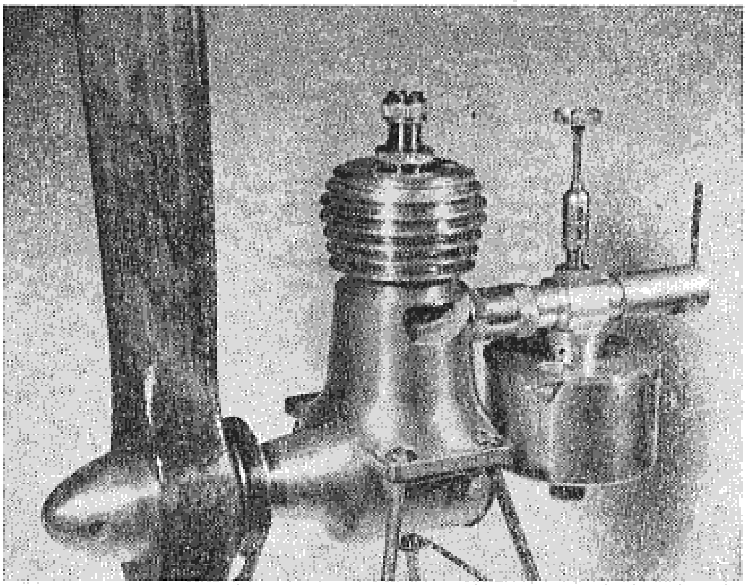
3. Where the engine will not pick up running, although it will "prime start", the mechanical part is all right and the fuel supply is wrong. The commonest cause is a choked jet. One case of which I have a lively memory was due to a little bit of thread, which allowed about half the usual fuel to pass, and when there was no fuel it clung to the side of the jet pipe and you could see clearly through the jet. That one took all day to find. Another very difficult case was due to a leak of air where the intake pipe was soldered to the cylinder. This reduced the suction at the jet, as quite a lot of air was being taken in through the leak without passing over the jet, and the engine ran very oddly. A similar result was encountered where the needle was sealed into the carburettor assembly by a piece of plastic pipe through which the needle ran. This stopped an air leak, but sometimes it moved outwards and the leak returned stopping the engine.

4. Where the engine is all right on the "prime start" but floods when the tank is filled, no matter what you do about the needle valve. This has been found twice. Once it was a flaw in the needle valve hole so that the needle could not seal it, being a "round peg in a square hole" so to speak. The second time was with a type of engine where the needle passes through a threaded bush into which it is soldered. The needle had become loose and its owner had soldered it again, but had not put it in the right place, so that the screw was full home before the needle closed the jet.

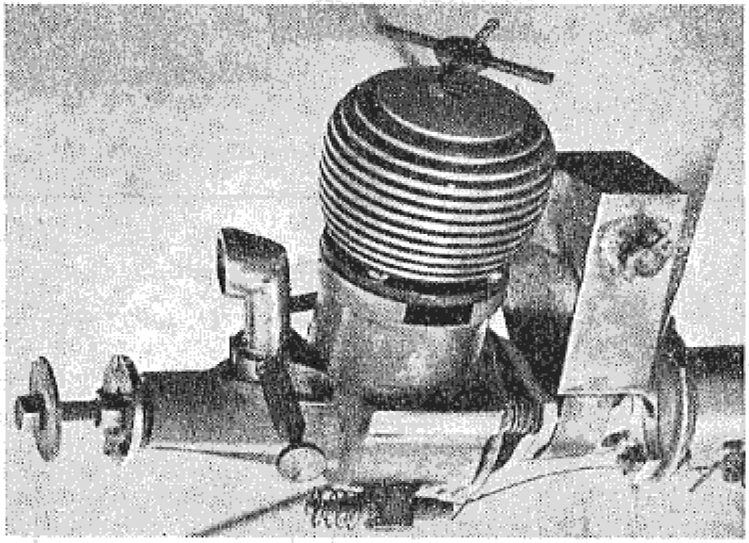
5. One engine would start and run all right until it became hot, when it slowed down and stopped, in spite of reduced compression. It was seen that the piston was dry after these stops, and more oil was tried. Finally 10 per cent. of castor oil in the fuel, plus a little more ether, were the cure. The ether seemed to cool the engine internally, and the castor oil stood up to the heat. This might be found with a rather tight new engine.

6. One engine had lost some power, but the piston seemed tight enough. On removing the head the space above the contra piston was found full of oil, and finally a leaky contra piston was proved the cause.

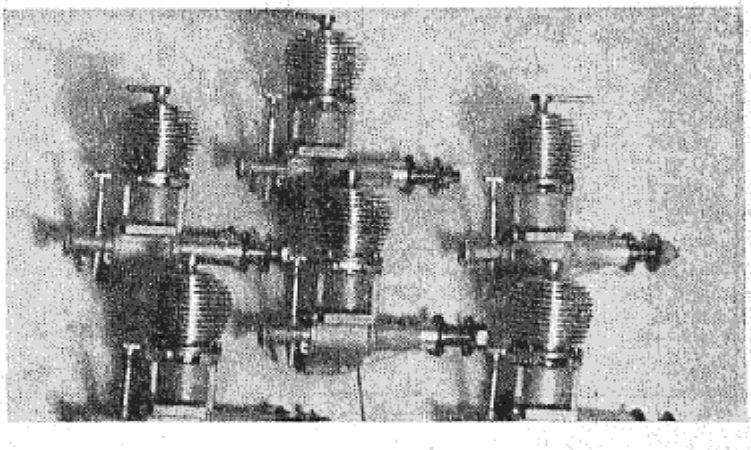
7. This one is a puzzle. The engine ran all right on the "prime start" but cut out later if the tank was not full. However, with a full tank it flooded. The flooding continued until the tank was ⅛ inch from full, than the fuel cut off and the engine stopped. It was found after some time that the jet, in this case, a brass fitting screwed into the tank top, was loose, giving a leak up the screw threads. With full tank this sucked fuel, and caused flooding. When the fuel was lower the leak sucked air and the engine stopped. After fixing the jet tightly the engine ran perfectly, but not before a day or two had been spent finding out why! This was the worst case encountered.

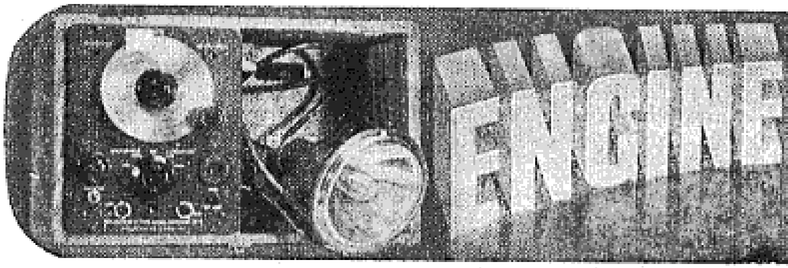


Above is a most interesting newcomer—a 3·5 c.c. diesel designed and built by a reader J. Robertson-Brown, and now with patents pending. It gives complete speed control from a tick-over to flat out owing to several unique features—a low (10:1) compression ratio, the special piston which improves scavenging and combustion, and an air control only. More details are promised later. The heading photo shows a popular New Zealand engine, the Pepperell 2 c.c.

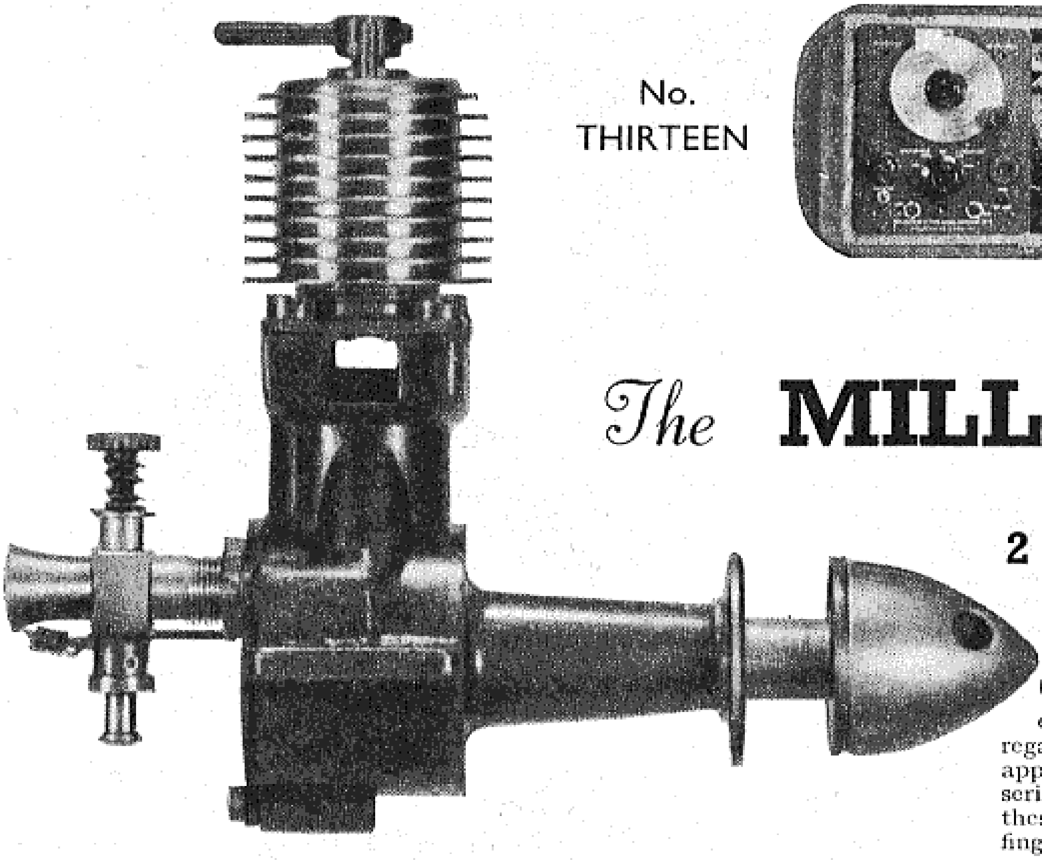


An interesting contrast in development and its relation to ease of starting is given by the photos above and below. The top photo shows the prototype Movo 10 c.c., giant Italian diesel which was demonstrated at the second International Week. It was remarkable not only for its power but its vicious and obstinate qualities as well. The lower photograph shows this engine as it was put into production—the bugs ironed out, and many improvements incorporated including a rotary disc inlet valve.



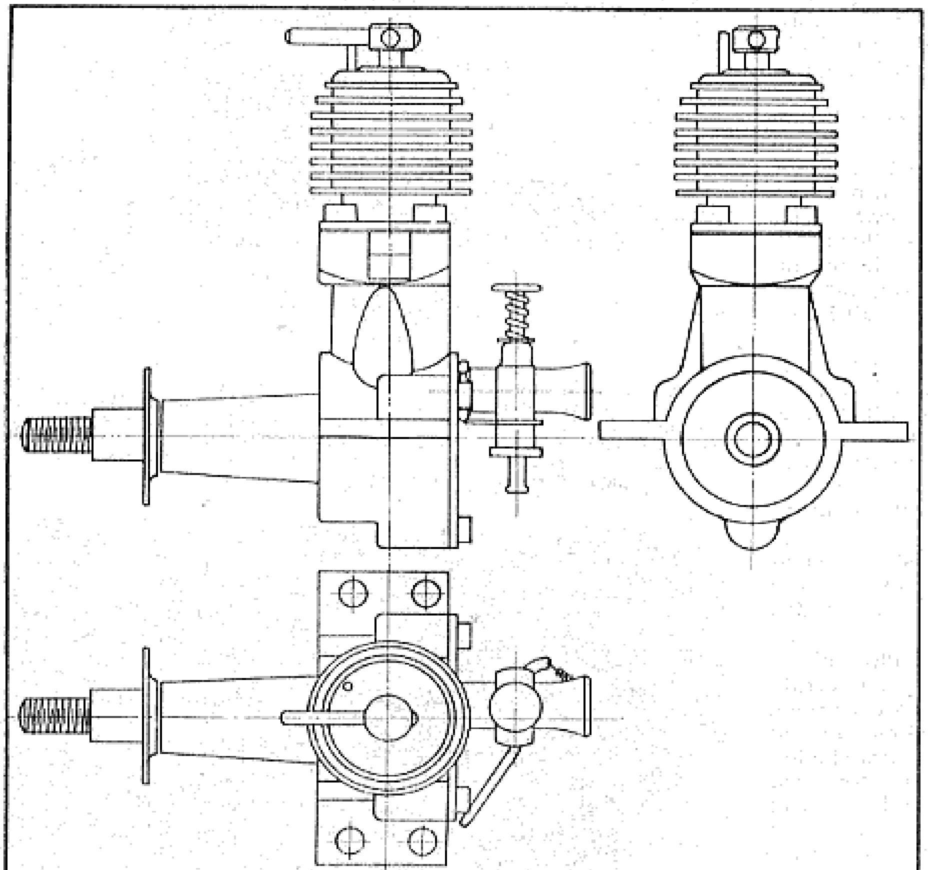


No. THIRTEEN



The MILLS Mk. III

2·4 c.c. DIESEL



ONE of the greatest difficulties connected with work of this kind is that it is extremely hard to obtain information regarding the results of other workers. It appears that the number of folk who have seriously embarked on a systematic test of these small engines might be counted on the fingers of one hand—leaving, possibly, a couple of fingers to spare. Furthermore, there is very little published data to which one may refer, so that the would-be experimenter is forced, not only to design and make his own apparatus, but to develop his own technique also. Most serious difficulty of all is that there is no available data against which results may be checked.

In view of this, I am pleased to record that I have recently received a great deal of useful information on the subject of these engine tests from Mr. N. K. Walker, B.Sc., of the L.S.A.R.A., who has sent me details of the test apparatus which this Society is using, together with a full description of the technique employed and the snags encountered. The information has been most helpful to me, and I have made modifications to my test equipment, and to my procedure, which has not only made the testing more simple, but which should add to a greater accuracy of results. This free interchange of hard-won knowledge has always been one of the most pleasing features of "full-sized" scientific research, and it is good to know that this unselfish outlook extends to the model world also.

The addition of an oil-dashpot damping device to the apparatus enabled extremely steady readings to be taken on the Mills Mk. III engine, especially at the higher speeds. Apart from this, the engine is noteworthy for its even running at all speeds tested, in fact, it is a very pleasant engine indeed to handle. Throttle control is positive, and there is no tendency for the setting to vary under vibration. The use of a rotary disc valve operating on the back crankcase-cover places the carburetter

BY

L. H. SPAREY

control-needle in a convenient and safe place, well away from the airscrew.

A sturdy compression-control lever still further adds to convenient handling. The Mills diesel engines were among the first to appear on the British market, and the manufacturers seem to have incorporated the results of this long experience in the design and production of this latest engine. No trouble or failures of any kind were experienced throughout the whole of the tests, which, considering their severity, indicates that the working parts are adequate for their job.

TEST

Engine : Mills Mk. III, 2·4 c.c. Diesel.

Fuel : Mills Blue Label, 2 parts : Ethyl Ether, 1 part.

Starting : Although cord starting was mostly used, this was purely for convenience, as the engine started readily by hand when tried experimentally during the course of the test.

Running : The even running of the Mk. III engine as marked at all reasonable speeds. At the very high range (above 11,000 r.p.m.) speed was, however, inclined to vary : this was due to the very rapid change in fuel level in the tank owing to the high rate of fuel consumption.

A cut-out is fitted to this engine, and it was found to be generally reliable at all useful speeds. It was uncertain in action at the extreme high range.

B.H.P. : Although the makers claim a maximum output of ·18 b.h.p. at 10,000 r.p.m. I was not able to hit this figure. Maximum output did, in fact, lie around this speed, as at 9,900 r.p.m. the peak was reached at ·167 b.h.p. This figure is extremely good for an engine of this capacity.

Beyond this speed the output fell fairly rapidly, until, at 10,900 r.p.m. it was ·118 b.h.p. At the other end of the scale, a minimum output of ·0906 b.h.p. was found at 4,800 r.p.m.

The graph indicates that it is necessary to keep fairly close to the 10,000 r.p.m. mark if maximum efficiency is to be obtained, it being especially necessary not to exceed this figure. An increase of only 350 r.p.m. drops the output ·006 b.h.p. On the lower side, however, decrease of 1,000 r.p.m. is required to equal this loss.

Power/Weight Ratio : ·486 b.h.p. /lb.

Remarks : From the general behaviour of the engine, and the extremely good power output, the Mills Mk. III seems to be one of the most successful of the British diesels. Propellers would, however, need to be carefully matched to the engine if its exceptional qualities are to be enjoyed.

GENERAL CONSTRUCTIONAL DATA

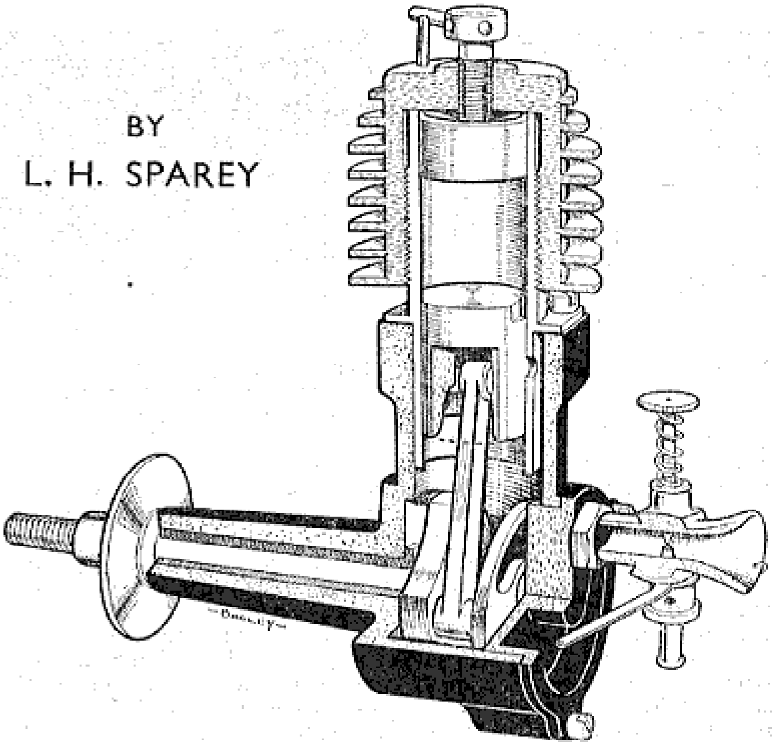
Name : 2·4 c.c. Mills Diesel.

Manufacturers : Mills Bros. (Model Engineers) Ltd., 143, Goldsworth Road, Woking, Surrey.

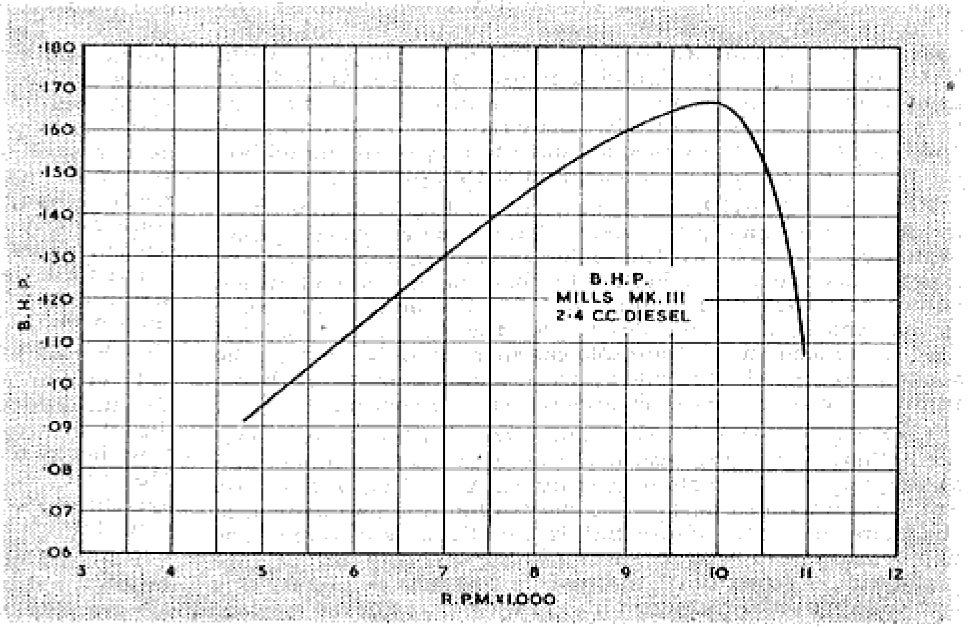
Retail Price : £5. 10s. 0d.

Delivery : Immediate.

Spares : Immediate.



Type : Compression ignition engine.
Specified Fuel : Mills.
Capacity : Cubic centimetres 2·4. Cubic inches ·147.
Weight : 6 ozs.
Compression Ratio : Variable 8 : 1 to 24 : 1.
Mounting : Beam, upright, and inverted.
Recommended Airscrew : 10 ins. by 5 ins.
Recommended Flywheel : 2 ins. O.D. by 7/16 in. thick. 5½ ozs.
Tank : Separate stunt tank supplied as standard equipment.
Bore : ·500 in.
Stroke : ·75 in.
Cylinder : Chromium/Molybdenum steel 2 ports. Cylinder bolts.
Cylinder Head : Dural, screwed.
Contra Piston : Ground and lapped central screw.
Crankcase : Magnesium pressure die casting.
Piston : Deflector head. No rings.
Connecting Rod : R.R.56.
Main Bearing : Phosphor Bronze.
Little End Bearing : Plain.
Crankshaft Valve : Rotary disc.



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Nordec Glo-Plug ..	£12	0	0
Keil Kraft CO² ..	£1	1	6
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Weight	5·75 oz.	R.P.M. (run in)	10,000
Bore	0·520 ins.	Static Thrust	35 ozs.
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GLIDER

Halfax Tern **10/–**, Halfax Albatross **25/–**, Keilkraft Invader **6/6**, Keilkraft Soarer Baby **5/–**, Keilkraft Soarer Minor **8/6**, Keilkraft Soarer Major **11/6**, S.J.A. Southern Sloper **6/6**, Frog Vanda **9/6**, Frog Fairey **7/6**, Frog Prince **25/–**

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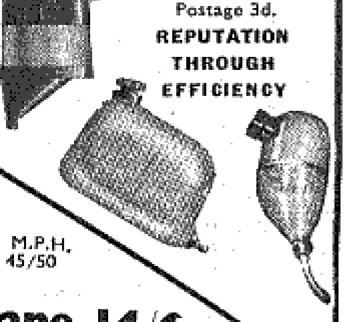

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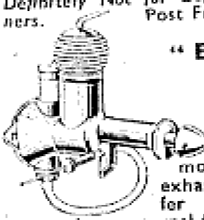

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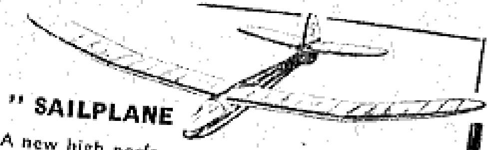

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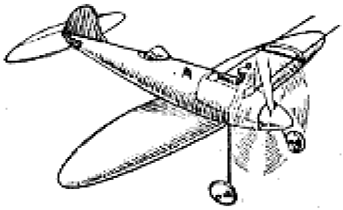

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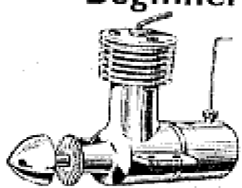

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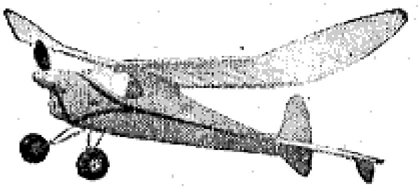

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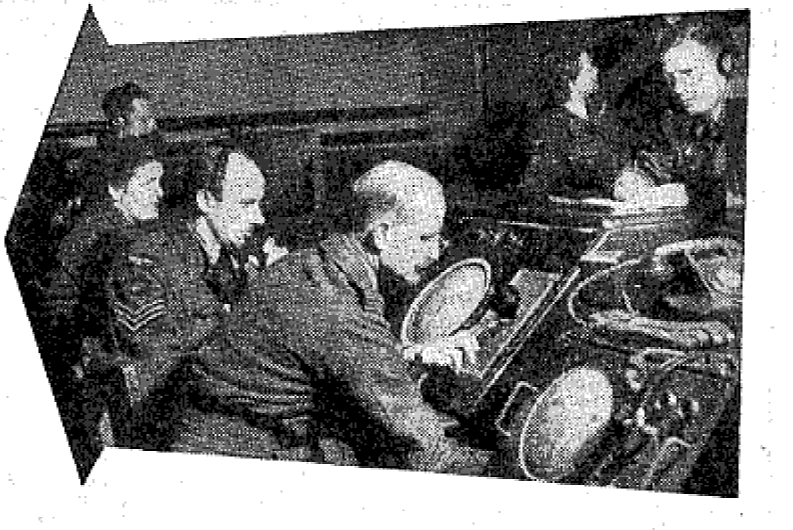

Fighter Control Units man the operations rooms and radar reporting centres through which the fighter control and raid reporting systems operate.

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Where are the units? Aberdeen, Belfast, Birmingham, Bournemouth, Chippenham, Dundee, Edinburgh, Exeter, Glasgow, Inverness, Ipswich, Liverpool, Llandaff, Newcastle-on-Tyne, Norwich, Nottingham, Peterborough, Pevensey, Plymouth, Sandwich, Stanmore, Stoke-on-Trent, Sutton-on-Hull, Thornaby-on-Tees, and Yeadon.

What are the terms of Service? Officers normally join for five years, airmen for four years: Women officers and airwomen for shorter periods.

What about training and pay? You train in your spare time, chiefly in the evenings and at weekends; and there is an annual period of 15 days' continuous training, usually at an R.A.F. station. In special cases part of the continuous training may be converted to shorter periods. Airmen and airwomen receive tax-free annual bounties of £9 and £6 respectively and supplementary bounties of £3 and £2 respectively for additional training. During periods of training of eight hours or more members are paid at R.A.F. or W.A.A.F rates. Travelling expenses are also paid.

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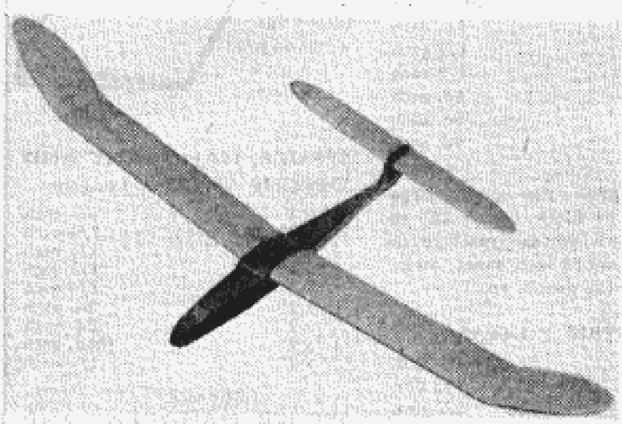
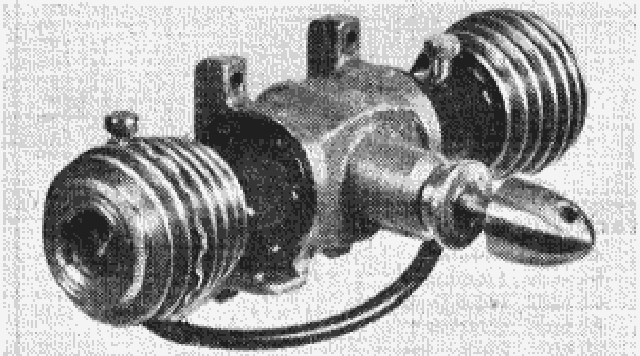


7 ft. wing span, high performance Sailplane, designed by Ray Silver. Conforming to F.A.I. regulations. Kit contains cut-out wing ribs, wing tips, tailplane ribs, shaped trailing edges, ample wood, tissue, cement, blue print, etc.



"LIONHEART" 2·48 Dsl./G.P.

Capacity 2·48 c.c. Weight 5½ ozs. Revs. per min. 6–7,000. Bore ·580 ins. Stroke ·595 ins. Recommended Revs. 5,500 (10 × 6 prop.)

OUTSTANDING POINTS OF NOTE.

1. Robust.
2. Beam or Bulkhead installation optional.
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7. Perfect set-up for Control Line running, incorporating centrifugal feed from tank to motor.
8. Sensible and simple "Cut-out" incorporated.
9. Full scale appearance lending itself to adaptation to Flying Scale models.
10. **NOT** a "flat twin" but the second cylinder is used as a fuel tank.

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Look out for Further Offers and New Kits next month.

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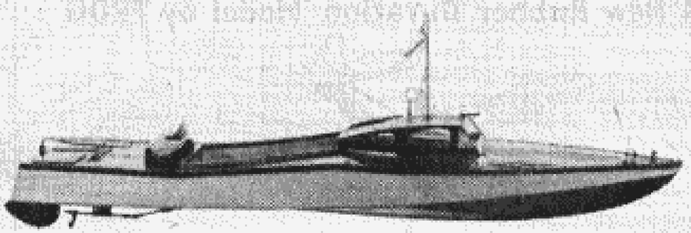
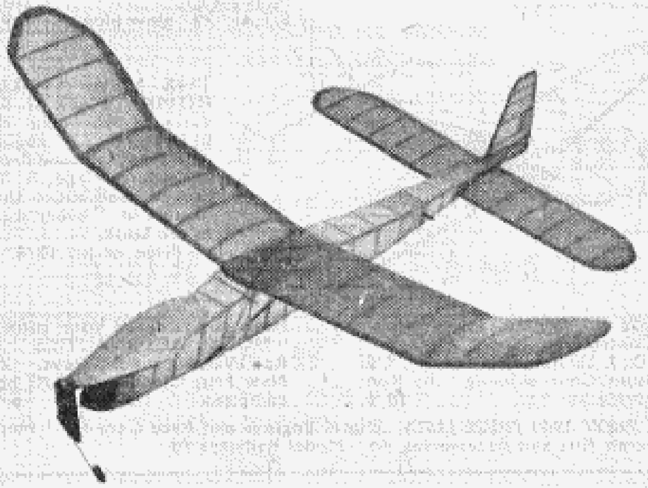


34 in. high-speed Cabin Cruiser. Designed by Cecil Phillips and suitable for any 2 c.c. to 3·5 c.c. diesel or petrol engine. Kit contains decking cut to shape, finished propeller shaft and tube and universal joint. Ample supply of spruce and other materials, blue print, etc.

"LUCIFER" 18/6



35 in. lightweight duration conforming to F.A.I. regulations, designed by Richard Vahey. Kit contains cut-out wing ribs, ample wood, tissue, cement, blueprint, etc. Finished single-bladed propeller.

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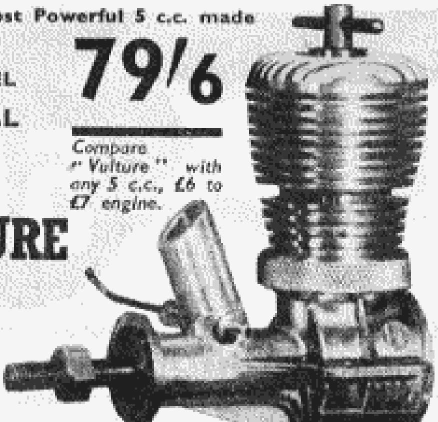

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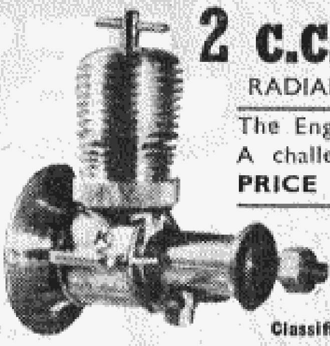

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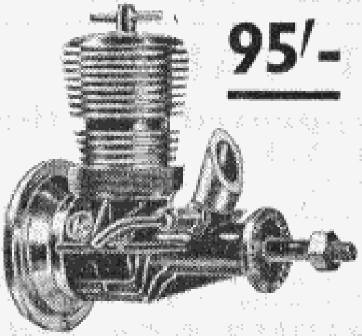

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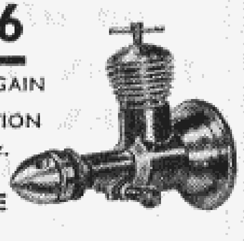

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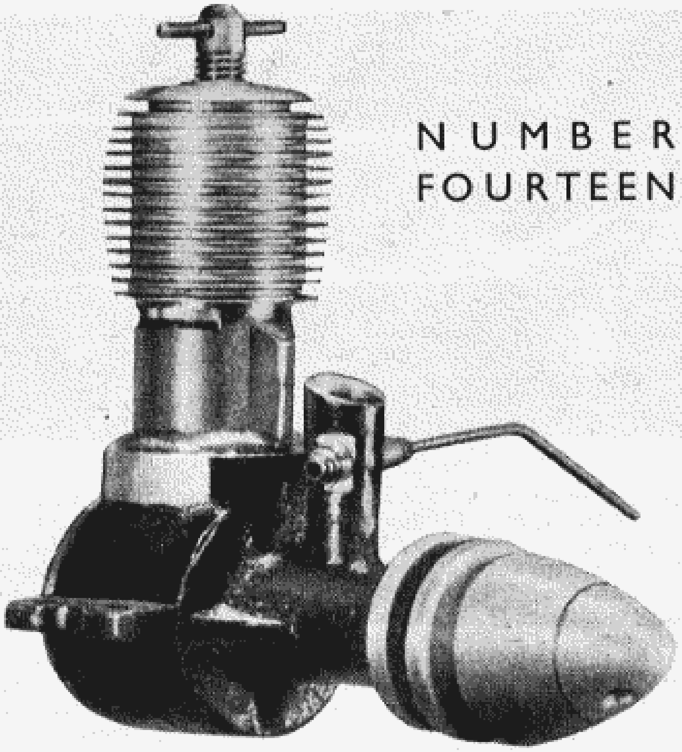


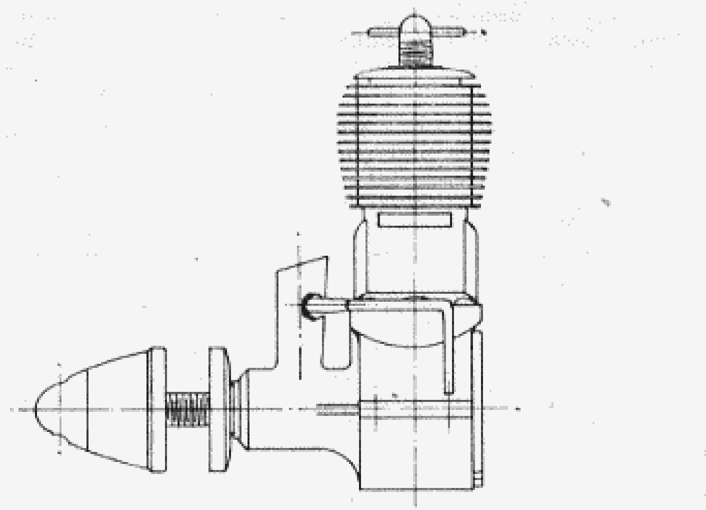
NUMBER FOURTEEN

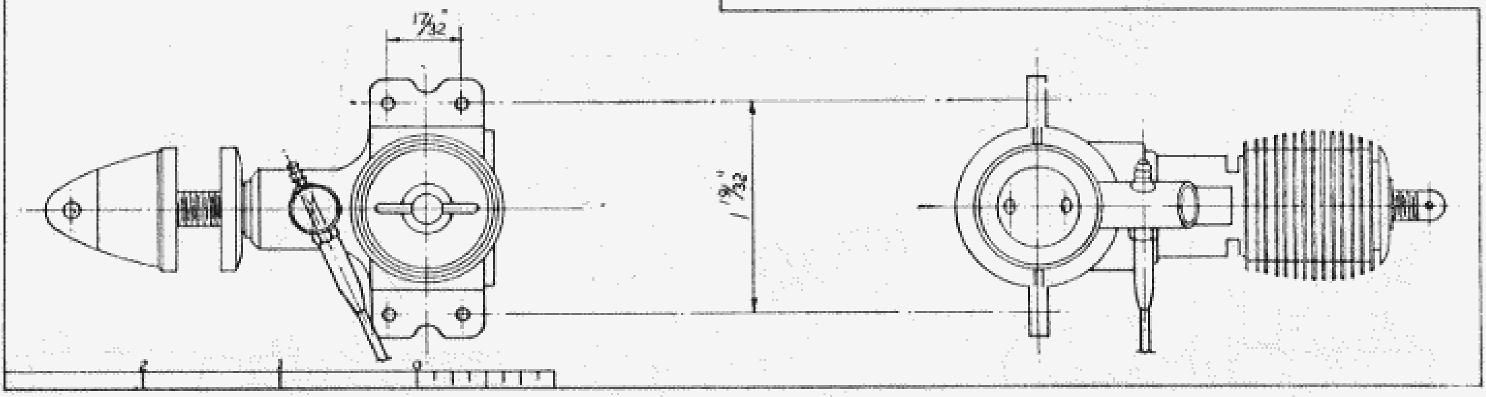
The WESTON 3·5 c.c. STUNT SPECIAL

ALTHOUGH of quite orthodox design this "Weston" diesel is of particularly pleasing appearance, due to the neat fixing of the cylinder to the crankcase, and to the general freedom from attached "bits and pieces." The makers claim that this engine has been specially designed for control-line work, and that the throttle control is such that it will adapt itself to the varying flight conditions met with in this branch of the pastime. In practice, it seems that this has been achieved by making the control extremely insensitive, so that it may not be so readily affected by sudden changes in flying conditions. While this is no doubt effective in actual use it certainly made the bench testing extremely difficult, as the engine is really only happy when running at about 6,000 to 7,000 r.p.m. Fortunately, this speed coincides with the point of maximum output; in fact, it was almost bound to do so because, at the extremes of speed, the engine ran in erratic, short bursts.

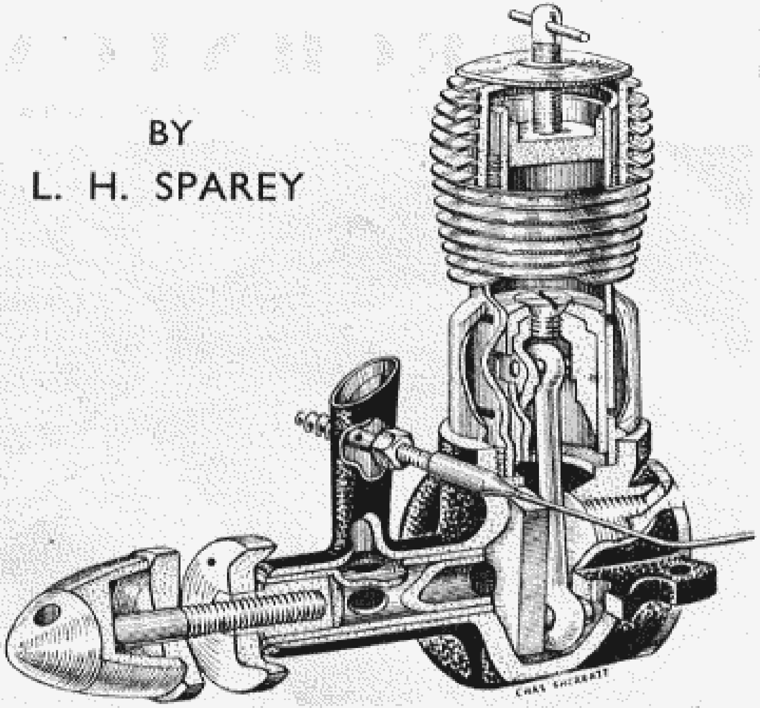
If this type of carburettor design makes for better flying performance, then the behaviour on the test bench is unimportant, so that it may not be quite fair to say that throughout the tests the carburettor was very much in the spotlight. The engine embodies a crankshaft type of rotary inlet valve, with the air intake cast integral with the bearing housing, while an extended shaft of the control needle is swept back so that the fingers are well clear of the propeller. This extended shaft tends to vibrate, and it was necessary to re-solder the shaft to the brass cap, as this broke away. The vibration also unscrewed the jet itself from the air intake-tube, and the nut could not be tightened sufficiently to prevent this. The jet is really a very thin tube, which is further weakened by the suction hole drilled through it, so that when the clamping nut was tightened in an effort to overcome vibration, the jet broke in halves. On fitting a replacement jet, the extended needle shaft was supported by a small bracket at its outer end, and this cured the trouble.

When the engine was correctly loaded, it ran well and evenly and the compression control was convenient and certain, but it must be confessed that the engine received rather a "pasting" in efforts to get even running at the extremes of speed. The results of this treatment became evident towards the end of the tests, when an ominous "clanking" from within told that something had given up—probably the big-end bearing. This finished the tests, although it would have been desirable to check a few of the readings at the lower end of the speed range. The impression was that the engine could do very much better down in this region than the graph would indicate.





BY
L. H. SPAREY



TEST.

Engine : Weston, 3·5 c.c. diesel.

Fuel : Maker's recommended.

Starting : Mainly hand-starting was used, although the cord-and-pulley method was resorted to for starting when lightly loaded for high speeds. Engine starts well by hand at its useful loadings.

Running : Runs well and steadily at speeds of approximately 6,000 to 7,000 r.p.m., but carburettor is not designed for flexibility of running. It must be remembered, however, that flexibility is no asset in model aeroplane work, but is necessary to obtain a power curve of any useful length.

B.H.P. : As was to be expected from the running characteristics, the power curve for this engine is rather steep, although not unduly peaked at the apex. We see, therefore, that while a maximum b.h.p. output of ·204 is given at 7,500 r.p.m. a drop of about 700 r.p.m. either side of this figure only reduces the output by ·004 b.h.p. At 9,000 r.p.m. the output is, by assumption, about ·170 b.h.p., while at the other end of the scale power is down to ·149 b.h.p at 4,000 r.p.m. The peak output may be considered good for an engine of this capacity.

Checked Weight : 4½ ozs.

Power /Weight Ratio : ·740 b.h.p. /lb.

Remarks : This engine is remarkable for having the exceptional power/weight ratio of ·740 b.h.p. per lb.—the highest of any engine yet tested. This is accounted for by the very light weight, 4½ ozs., although there is no petrol tank fitted. Even with a reasonable allowance for this, the figure would still be exceptionally high. At the same time, it is felt that this light weight has been attained, to some degree, by a sacrifice of a few details which would prove of benefit, such as a more sturdy design of the carburettor. This is the only point of criticism, as the rest of the engine seems very pleasing indeed.

GENERAL DATA

Name : Weston 3·5 c.c. Stunt Special.

Manufacturer : Messrs. Weston Model Aero Supplies, 1, Oxford Street, Weston-Super-Mare.

Retail Price : £4. 10s. 0d. inclusive of purchase tax.

Delivery : Ex stock.

Spares : Ex stock Engine must be returned for servicing.

Type : Compression Ignition (Diesel).

Specified Fuel : Mercury No. 3.

Capacity : 3·5 cubic centimetres, ·215 cubic inches.

Weight : Bare 4½ ozs.

Compression Ratio : Variable.

Mounting : Beam, upright and inverted.

Recommended Airscrews : 9×6 Tru-flo Stunt. 8×8 Tornado Toothpick Speed. Use standard flywheel spinner.

Tank : Not supplied.

Bore : ·625 ins., 15·375 m.m.

Stroke : ·687 ins., 16·450 m.m.

Cylinder : Heat-treated Vigilant steel.

Cylinder Head : High grade Duralumin.

Contra Piston : 5 per cent. nickel chrome steel.

Crankcase : Die cast aluminium.

Piston : Mehanite.

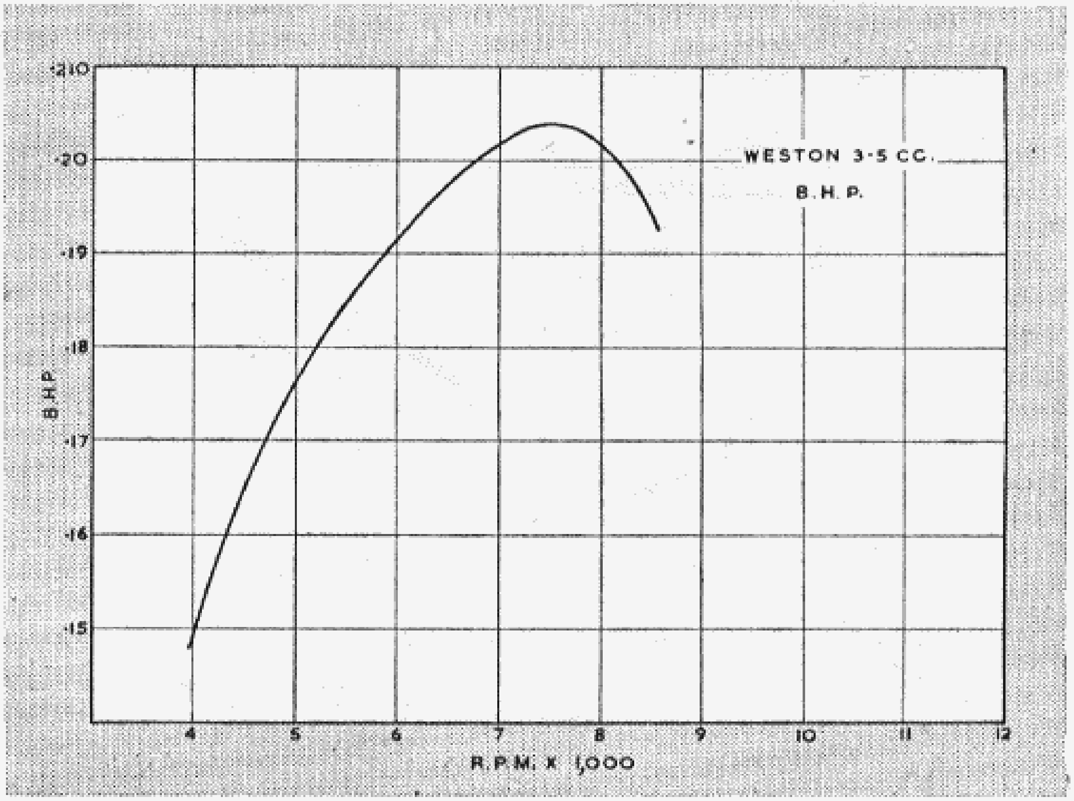
Connecting Rod : Hyduminium alloy.

Main Bearing : Plain.

Little End Bearing : Plain.

Valve : Rotary crankshaft.

Special Features : Light alloy bolt type crankshaft extension incorporating spinner to reduce broken crankshaft. Replacement bolts 2s. each.
Special Flywheel Spinner available for speed flying.



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HAWKER SEA FURY ..	**22/6**

POWER F/F

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KEIL INVADER ..	**6/6**
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DURATION

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KEIL AJAX	**6/-**

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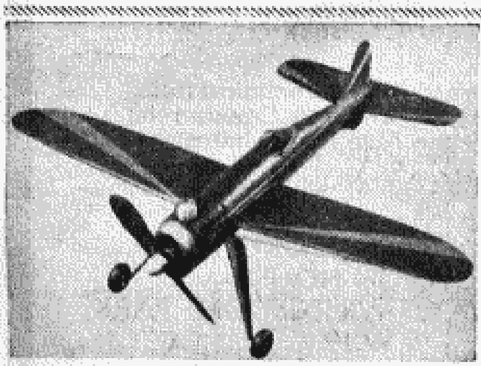

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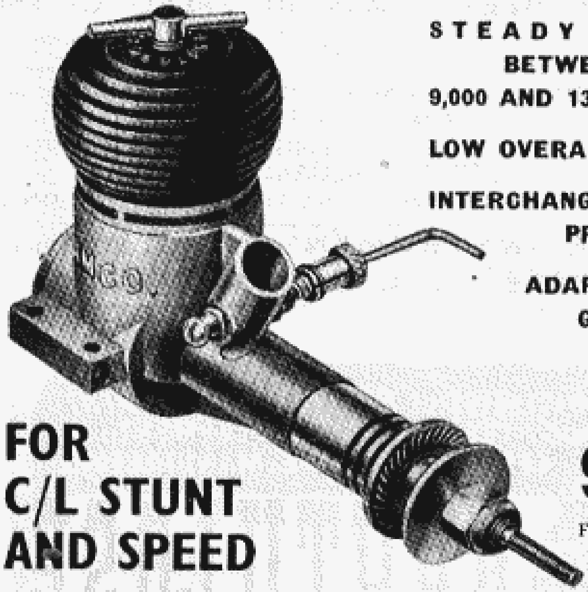

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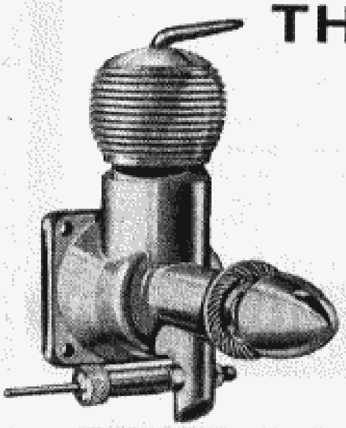

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