

# THE MILES KESTREL TRAINER M. 9



(Scale 1 in. to 1 ft.)

*Designed and constructed*

*by J. H. TOWNER*

*Mr. J. H. Towner launching his model.*

**T**HE Miles Kestrel Trainer, now going into production for the Royal Air Force, is for the purpose of training pilots to fly the new types of low wing high-speed fighter jobs. Fitted with a Rolls-Royce Kestrel engine, it has a top speed of around 290 m.p.h.

Scaling down this high performance prototype presented unusual difficulties in low-speed aerodynamics as applied to model work, especially with a wing section having at its root a thickness to chord ratio of 25 per cent.

The model also is intended to fly without an undercarriage, which in flight gives it the appearance of the undercart being fully retracted. All landing stresses have been taken care of, and the model will touch down at speed on its "tummy" without doing any damage, and ensures it finishing the "right way up."

The construction is fairly simple, and in order to ensure the correct positioning of various parts, such as formers, ribs, spars, etc., these are cut out on the egg box principle, that is, slots are cut in one part which register with slots cut out in the part to which it has to be fixed.

We take as our datum line the two main longerons lying along the centre line.

These longerons are made of hard balsa  $\frac{1}{8}$  in. square, steamed to shape, and pinned down upon the plan. It

is advisable here to insert three or four cross pieces to maintain its shape while building, which will be taken out at a later stage.

The lower formers are made from  $\frac{1}{16}$  in. sheet balsa and braced across the grain, with  $\frac{3}{32}$  in. square lengths. These formers are then cemented in place, care being taken to see that they are perfectly square and vertical.

You will note that the fuselage is being erected upside down. Now add the keel longeron, also  $\frac{1}{8}$  in. sq. balsa carefully steamed to shape before cementing. Fix the centre section ribs in place. Rib M is so designed that by inserting it on the flat through the cut-out portion of former "d" and turning it through 90 degrees, it will assume its position and lock altogether firmly.

The leading edges are pushed into their respective slots in the ribs, and a packing piece cemented to the keel longeron to take their inner ends. Note the trailing edges of the centre section are made in two pieces in order to keep the grain of the wood running more or less parallel to the edges. Note slots in former "g" to receive the rear ends of trailing edges.

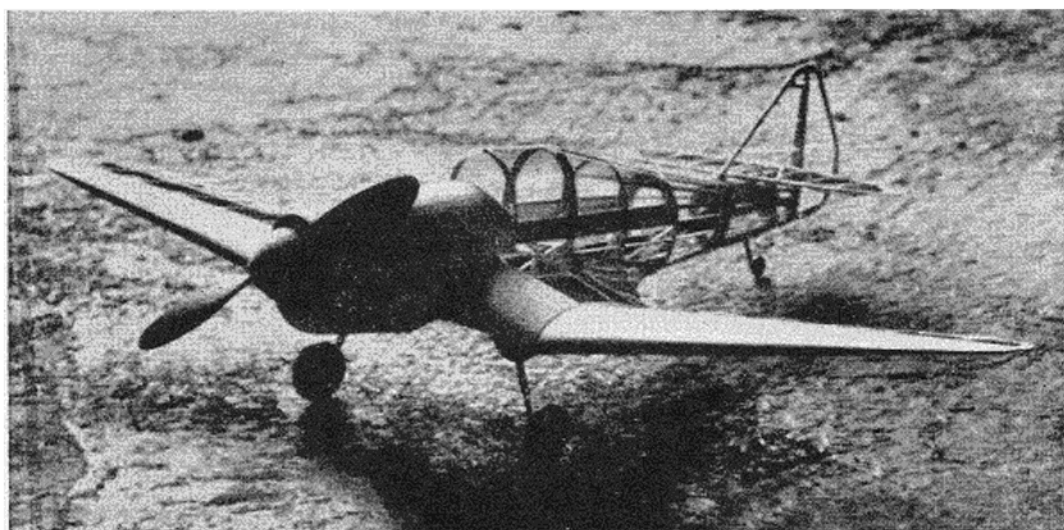
The partly completed fuselage can now be lifted off the plan, and formers A B C D cemented into place with a  $\frac{1}{8}$  in. square longeron connecting their tops.

Now fix in place all  $\frac{3}{32}$  in. diagonal braces. You will

observe that they start at the front end at each side longeron, converge to the keel at former "b," then spread out and upwards to the side longerons at former "c," and converge again downwards to the keel, and so on as far as former "g."

You will see that the main longerons project above the formers by  $\frac{1}{16}$  in. on the front part of the fuselage. This is to allow for the  $\frac{1}{16}$  in. balsa covering on the cowling, which can now be added. Strips  $\frac{1}{4}$  in. wide and  $\frac{1}{16}$  in. tapering in width to the front, are cemented and pinned in position as far round as the radiator cowling underneath, except between formers "a" and "b," when the strip should be continued right round. The radiator cowling front can now be carved and cemented in position, and the rest of the strip,  $\frac{1}{4}$  in.  $\times$   $\frac{1}{16}$  in. balsa continued round to complete the cowling.

The centre section fairing into the fuselage consists of a  $\frac{1}{8}$  in.  $\times$   $\frac{1}{16}$  in. strip of balsa, carefully steamed to shape, springing from the leading edge, curving upwards and flowing back to former "d," where the trailing edge terminates. Formers "c" and "h" can now be cemented in place, and all longerons and paper supporting strips can be completed.



\* \* \*

*These two photographs give a good indication of the construction of the model. Span is 39 in.; weight, complete with rubber motor, 9½ oz.; performance, 25-35 sec. The model is fitted with wheels, and will, of course, rise off the ground; but normally it is flown without them, thus giving the impression of flying with the wheels retracted. The underside of the fuselage is specially reinforced to take landings on its "tummy."*

\* \* \*

The front part of the wing roots can now be covered with  $\frac{1}{32}$  in. sheet balsa, which helps to make all rigid, and at this stage it will be as well to fix the  $\frac{1}{4}$  in. hardwood dowels for the wing fixings, making sure they are quite parallel. The centre lines of these dowels are shown on the half-front elevation. We can now take out the temporary cross bracings, and proceed with the cabin top. The three formers which carry the celluloid are made of  $\frac{3}{32}$  in. balsa steamed to shape and pinned down on a board on edge. An inner  $\frac{1}{32}$  in. strip is then cemented in place, and when all is dry we have a strong two-ply fixture, which will keep its shape. Do not forget to insert paper between the board and the formers while in construction, to prevent sticking. Note the  $\frac{1}{16}$  in. vertical pieces shown in detail, which continue up four formers "e" and "f" to give rigidity.

The windscreen is cut from a clean knitting wool container, or other suitable object, obtainable at any popular 6d. bazaar, and firmly cemented in place. Very great care must be exercised here to see that no cement shows on any part of the celluloid which is visible. Probably the best method is to "spot cement," that is, a spot

here and there to tack into position. And when set add further cement until all is firm. The other windows are added in three separate pieces of light celluloid, and the joints finally covered with thick writing paper.

The wings are quite straightforward, cementing the slots in the ribs into the slots in the formers.

One word of caution on this method. Do not make the slots too big; it is far better to make them a tight fit, otherwise the tightening effect of the cement may tend to draw the slots together and distort the whole job. The paper tubes can be fitted, being sufficiently long to be pushed through holes in both the first and second ribs for support. Care must be exercised here to see that both wing tips are each the same height on assembly, that is, 1 in. above the centre line of the fuselage. Less than 1 in. may cause the model to spin in flight.

Although the actual dihedral is built into the wings automatically, yet it is essential to check this for any error that may have occurred. Whilst on this subject, although all slots for the minor stringers are shown on the formers, it is as well to cut them out after assembly to ensure the longerons having clean sweeping curves.

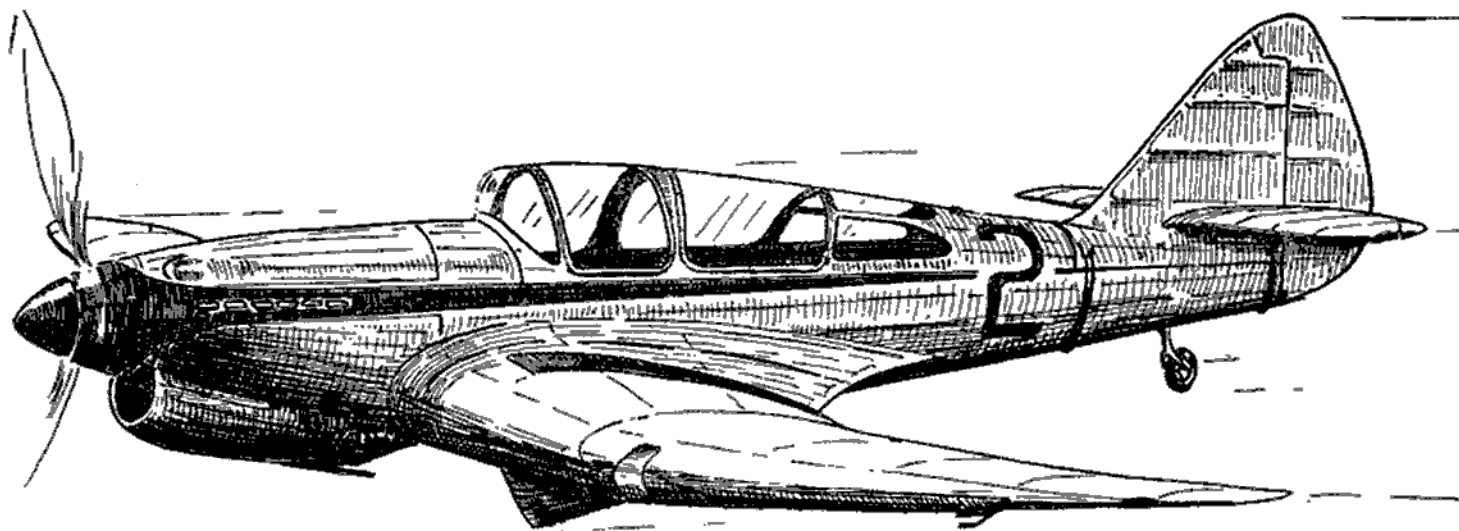
Cover the leading edge of the wing from the top of the main spar round the front and underneath to a small spar running the full length of the wings. If well steamed this balsa will go on quite easily and makes the wing very strong and rigid.

The tail unit is quite orthodox, and is detachable, with a small part of the top deck. The sketch shows how the elevator is inserted through the fin, and the balsa covering here makes it quite easy to cover with paper without getting any bad wrinkles. Note a small dowel at the end of the fuselage to locate the tail. Also two small pieces added to the bottom of the front end of the tail to register inside the main longerons.

The whole is kept in place with rubber bands and hooks.

Full details of the gear assembly is shown on the drawing and should need no explanation, except to add that an odd number of gears is used to obtain length of motor run, and not to avoid distortion of the fuselage.

The propeller can be carved from hardwood or a suitable one purchased. Actually, the propeller on the original model was a proprietary one known as



"Pawlonia." A  $\frac{1}{16}$  in. three-ply 2 in. dia. disc was cemented to the back, and the spinner built up with odd pieces of balsa, and sanded to shape. This is probably far easier than attempting to carve an air-screw and spinner complete in one piece.

If you are not gifted in carving propellers I strongly advise purchasing a ready made one, because however well the model may be constructed we must get the greatest efficiency from our rubber. A 12 in. air-screw with 15 in. pitch is advised, although different propellers can be fitted as required by removing the screw in the driving plate through a hole provided in the back plate. See detail on the drawing.

An undercart is made for display purposes, and can be used for speed contests. It consists of a short length of expanding curtain rod with piano wire pushed through and well soldered either end, one end turned at right angles to form the axle. Attached firmly to the upper end is an "U"-shaped wire, which holds all snug in place. The whole unit (there are two, of course, one for each wheel) is a push fit in the "carved from solid" wheel fairings. This construction of undercart lends itself admirably to scale construction, and gives ample movement to absorb landing shocks.

The whole model is covered with white Japanese tissue, water tightened and doped. The covering includes the

cowling and balsa sheet on the leading edges of the wings. Decoration consists of a black spinner with a broad black band tapering to nothing at former H, and a larger black figure 2 between formers G and H, either side.

This, of course, will not be the R.A.F. colour scheme, but was used on one of the experimental prototypes.

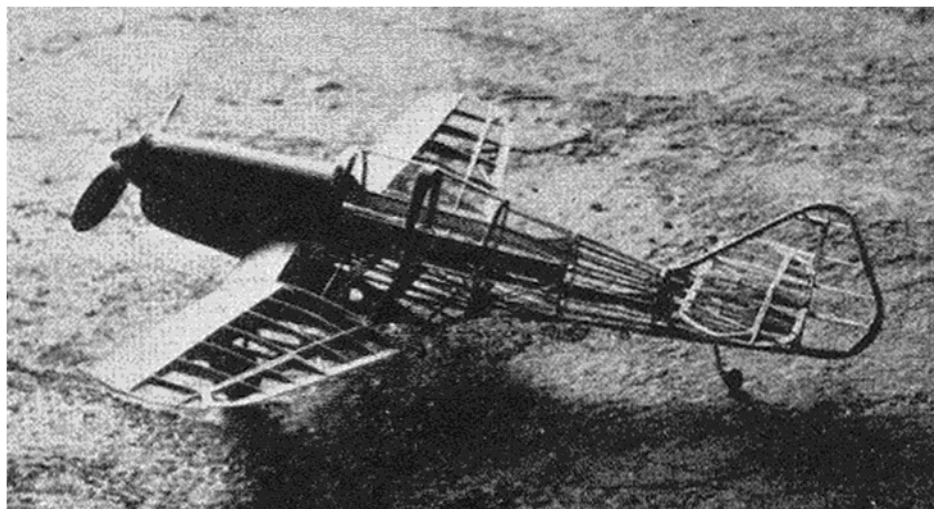
The model is powered with three motors of four strands, each  $\frac{1}{4}$  in.  $\times$  1-20 in.  $\times$  18 in. long, well-lubricated rubber.

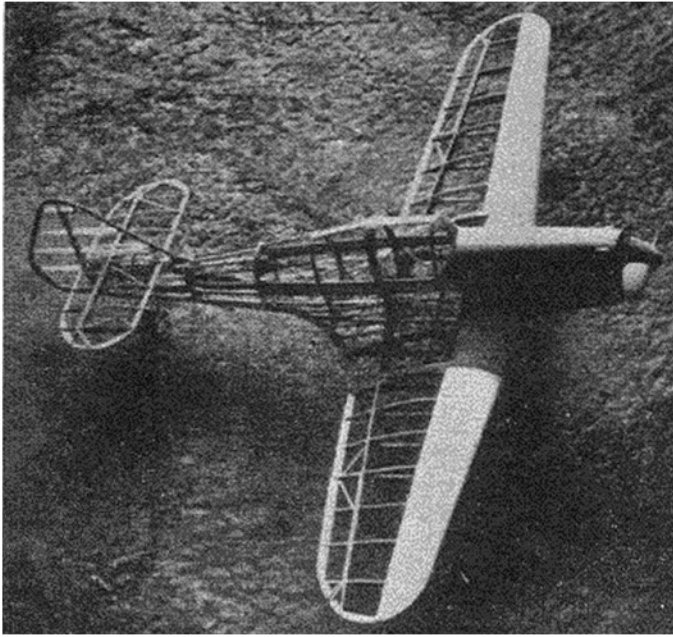
Trim is obtained by adding a lead weight to the under side of the nose, and when correct can be cemented in place, although you will observe that a final trim can also be obtained by using either one or the other rear rubber dowels. This is also very useful when fitting a different motor or different combination of strands and thickness.

Flying is quite straightforward. Do not use the ailerons to correct for torque, as when the motor is run out the model may tend to go into a spin. The side-thrust and downthrust take care of torque, so that the model should fly with all controls neutral.

Launch fairly fast (into the wind, of course) and you should be rewarded with a long, steady and spectacular flight.

Above is shown a fine sketch by Mr. Towner, depicting his model in flight. Overleaf is printed a full list of materials required for this model. Also is printed a page-size reproduction of the full-size scale plan, 40 in.  $\times$  27 in., available for 3s. post free from our Leicester offices. These plans contain every part fully detailed, and with the aid of the instructions here published readers may build this plane with confidence.





It is not advisable to fly in windy weather, and trial flights should be carried out over long grass.

The total all-up weight in flying trim is  $9\frac{1}{4}$  ounces with a wing area of 210 square inches. The airscrew spinner and gear assembly should weigh  $1\frac{1}{4}$  ounces, and the added weight anything from  $\frac{3}{4}$  to 1 ounce, depending on how light you have managed to construct the rear part of the model.

#### LIST OF MATERIALS REQUIRED.

- 3 ft.  $\times$   $\frac{1}{8}$  in. sq. hard balsa, 3 lengths. Main longerons.
- 3 ft.  $\times$  3 in.  $\times$   $\frac{1}{16}$  in. balsa, 4 lengths. Cowling, formers, ribs, etc.
- 3 ft.  $\times$  2 in.  $\times$   $\frac{3}{32}$  in. balsa, 1 length. Main spars.
- 3 ft.  $\times$  4 in.  $\times$   $\frac{1}{32}$  in. balsa, 1 length. Leading edge covering.
- 3 ft.  $\times$  2 in.  $\times$   $\frac{1}{32}$  in. hard balsa, 1 length. Tail ribs, etc.
- 3 ft.  $\times$   $\frac{3}{16}$  in. sq. balsa, 1 length. Rib bracing.
- 1 ft.  $\times$   $\frac{1}{4}$  in. round birch dowel. Wing fixing.
- 1 ft.  $\times$   $\frac{1}{8}$  in. round birch dowel. Motor rear fixing.
- 2 in.  $\times$   $1\frac{1}{2}$  in.  $\times$  1 in. hard balsa. Radiator cowl.
- 6 in.  $\times$  1 in.  $\times$  1 in. hard balsa. Undercarriage fairings.
- 1 pair celluloid 2 in. balloon wheels.
- 1 pair celluloid  $\frac{3}{4}$  in. tail wheels.
- Celluloid, 12 in.  $\times$  6 in. light gauge.
- Celluloid windscreen cut from wool container.
- $\frac{1}{8}$  in. hardwood ply. 12 sq. in.
- $\frac{1}{16}$  in. hardwood ply. 4 sq. in.
- $\frac{1}{2}$  in. brass gears, 3.
- 16 s.w.g. steel wire for shafts.
- 3 brass bushes screwed and nuts. And cup washers.
- 18 s.w.g. 12 in. long. Landing gear.
- Expanding curtain rod,  $\frac{1}{8}$  in. dia. outside, 6 in. long. Undercarriage.
- 24 s.w.g. retaining hooks. 12 in. long.
- Rubber  $\frac{1}{4}$  in.  $\times$  1-20 in. 6 yards.
- Light-weight paper, white, 20 in.  $\times$  30 in. 2 sheets.
- Aluminium foil, 3 in.  $\times$  2 in., for hinges.
- Valve tubing, dope, etc.