

Railway engine

Finished length
48cm (19in).

Tools required

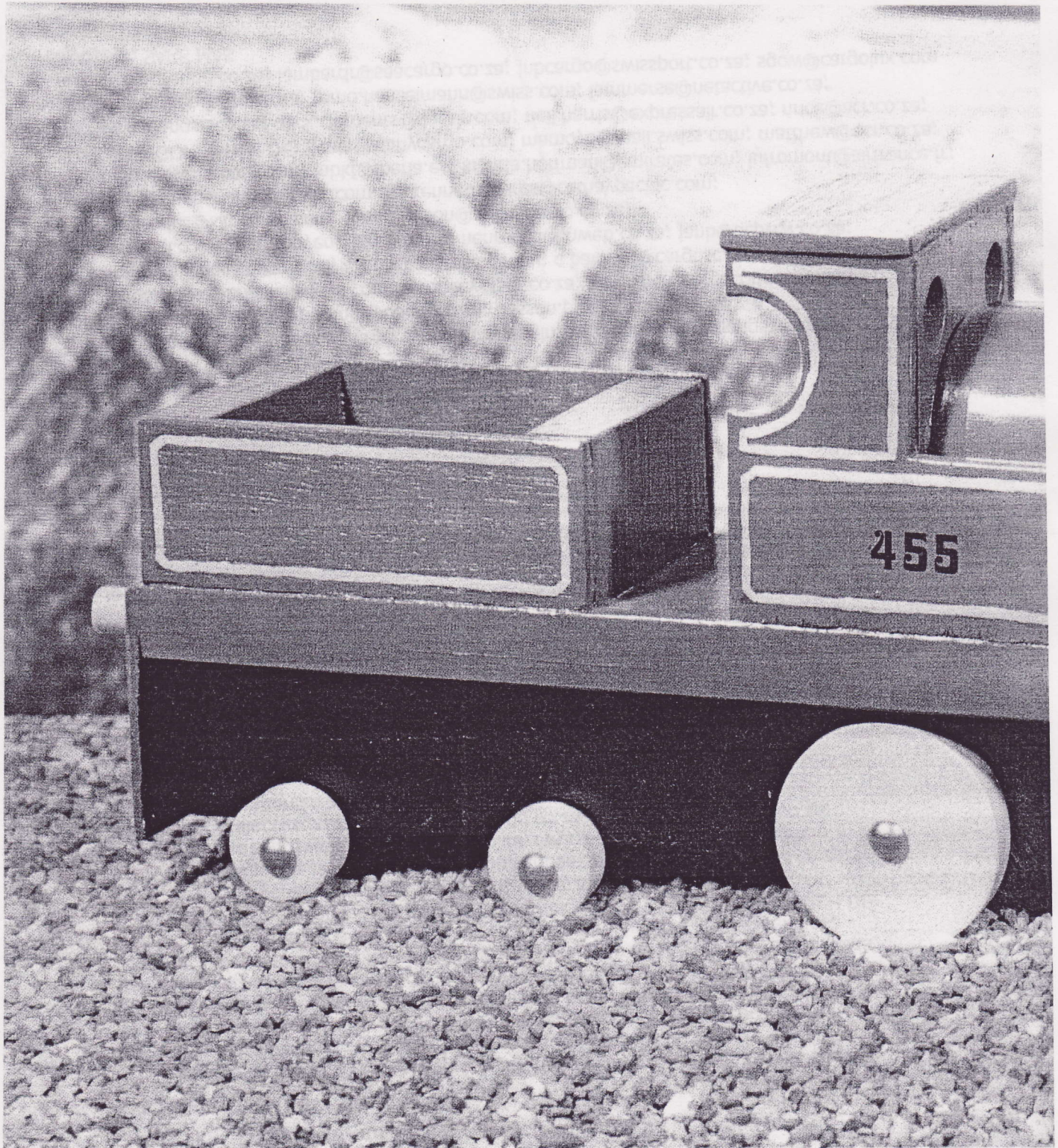
Tenon saw; fretsaw; vice; G-clamp;
electric drill with 2mm ($\frac{5}{64}$ in) and

6mm ($\frac{1}{4}$ in) bits, 19mm ($\frac{3}{4}$ in) flat bit;
countersunk bit; hole saws (6.4cm
and 3.2cm) ($2\frac{1}{2}$ in and $1\frac{1}{4}$ in) diameter;
small hammer; crosshead or slotted
screwdriver appropriate to screws;

pencil; ruler, try-square, paint
brushes; large plastic funnel
scissors; compasses (optional).

Techniques involved

Shaping plywood and dowel; drill



ing; wheels; painting.

Materials

96cm (37½in) of 5cm × 2.5cm

(2in × 1in) softwood

71.5cm (28½in) of 10cm × 2.5cm

(4in × 1in) softwood

1m × 10cm (39½in × 4in) of 6mm (¼in)

plywood

61cm (24in) of 6mm (¼in) dowel

12cm (4¾in) of 2.5cm (1in) dowel

7.5cm (3in) of 12mm (½in) dowel

plastic detergent bottle, 26cm

(10½in) long

1kg (2.2lb) plaster of Paris

16 small plastic electric cable clips

16 No. 1 countersunk screws 15mm

(⅝in) long

12 No. 6 countersunk screws 3.8cm

(1½in) long

4 No. 6 countersunk screws 4.5cm

(1¾in) long

40g (1½oz) box 12mm (½in) panel pins

1 × 6mm (¼in) screweye

12 brass upholstery nails, 10mm (⅞in)

long

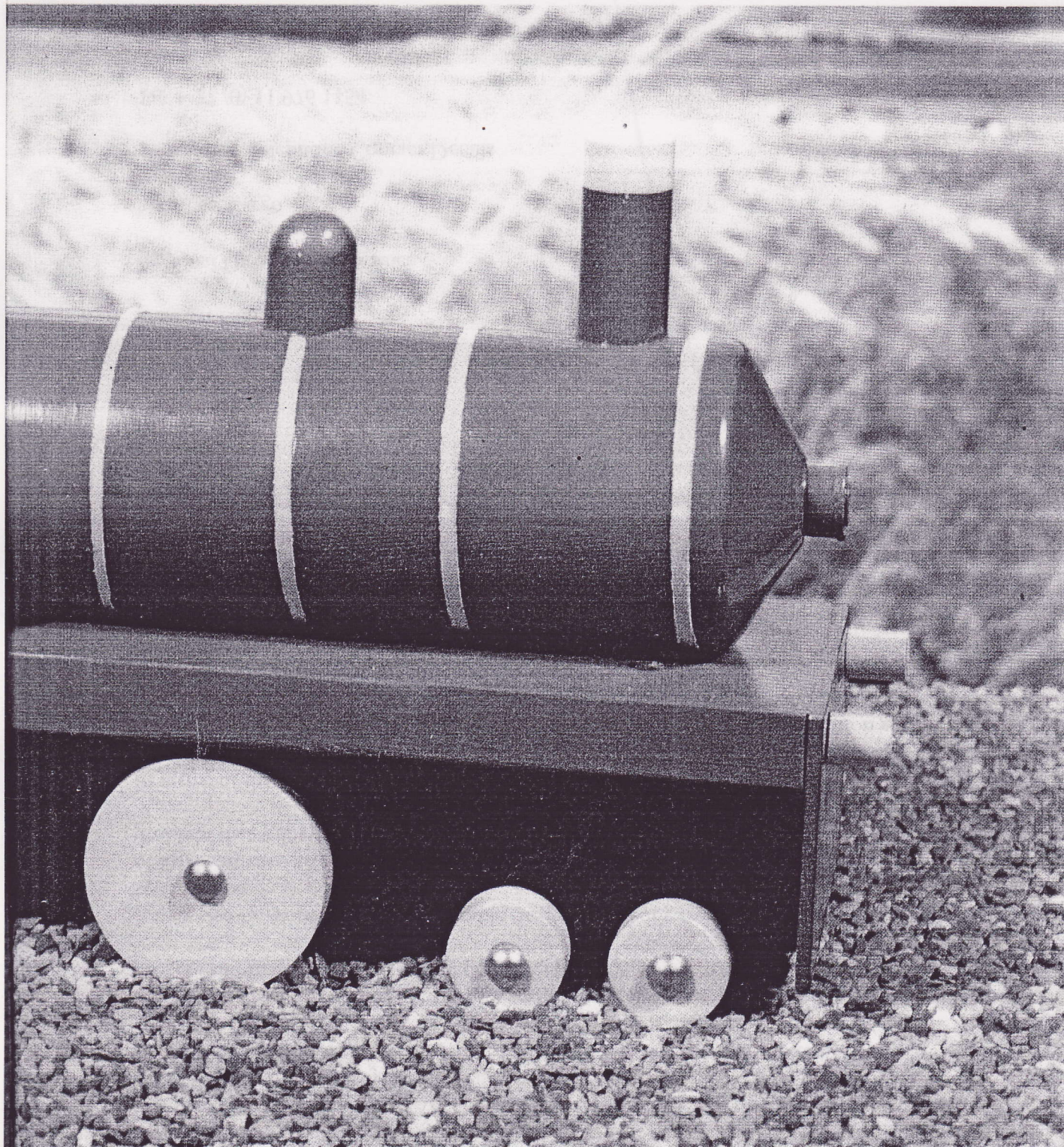
2 discarded plastic lids from coffee

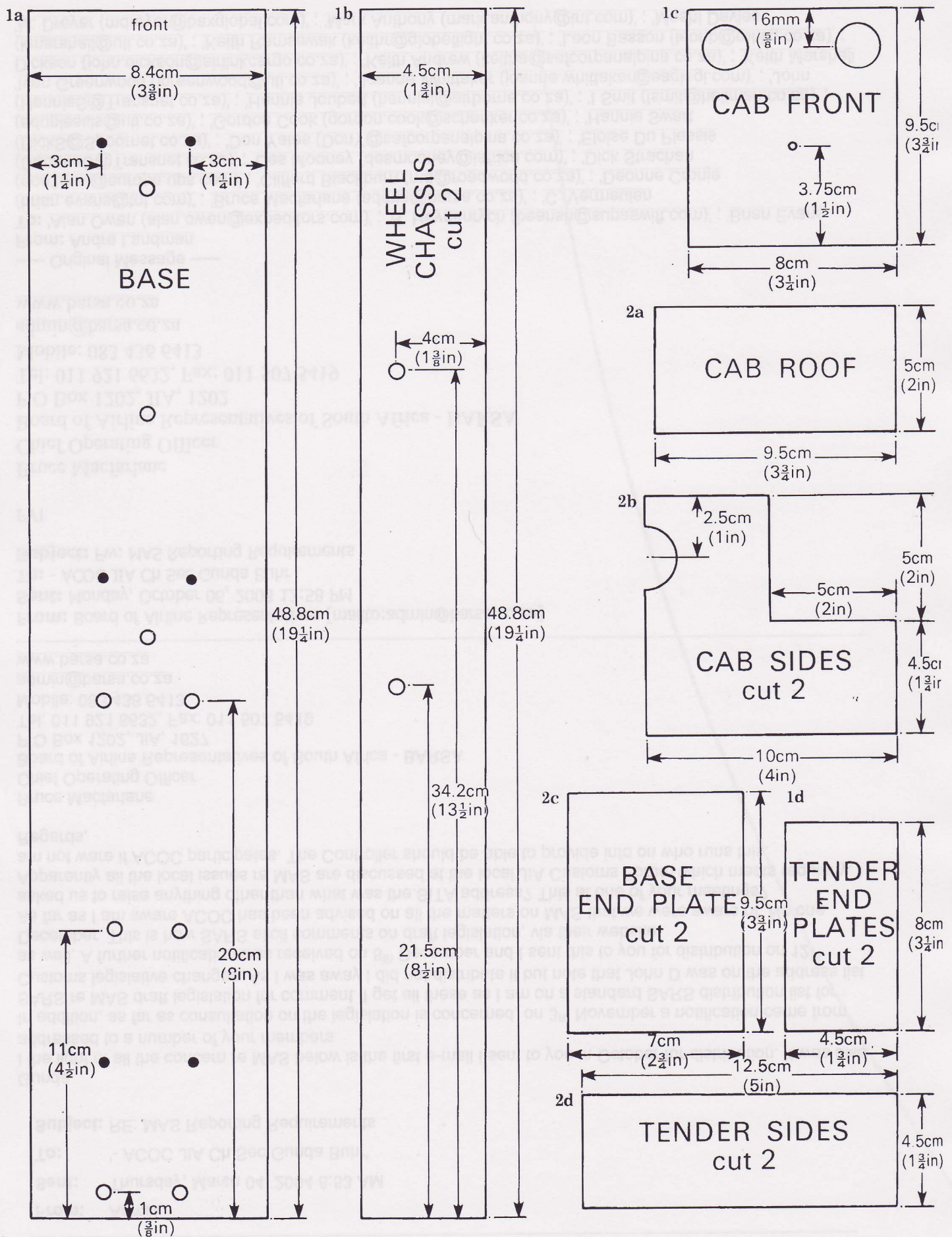
tins or similar

contact adhesive

fine glasspaper

enamel paints





Construction

Mix plaster of Paris with water to the consistency of thick cream. Remove top from the neck of the detergent bottle and pour in the plaster using a plastic funnel. Pour slowly to avoid a build-up of air bubbles and squeeze the bottle occasionally to make sure that it is

1a,b,c,d. Measurements for base, cab front, tender end plates and wheel chassis sections.

2a,b,c,d. Measurements for plywood parts of engine.

completely filled. Leave for several hours to allow plaster to set. When the plaster has hardened, mark a line down one side of the bottle. Measure 2cm ($\frac{3}{4}$ in) and 13cm ($5\frac{1}{8}$ in) down from top and mark these points. Drill 2.5cm (1in) holes, 12mm ($\frac{1}{2}$ in) deep at each marked point.

Following measurements in fig. 1 mark out and cut one base, two tender end plates and one cab front from 5cm \times 2.5cm (2in \times 1in) softwood. Mark and drill six 2mm ($\frac{5}{64}$ in) pilot holes (marked A) and counter-sink on upper side of base. Mark and drill holes B, C and D and counter-

sink on the underside of the base.

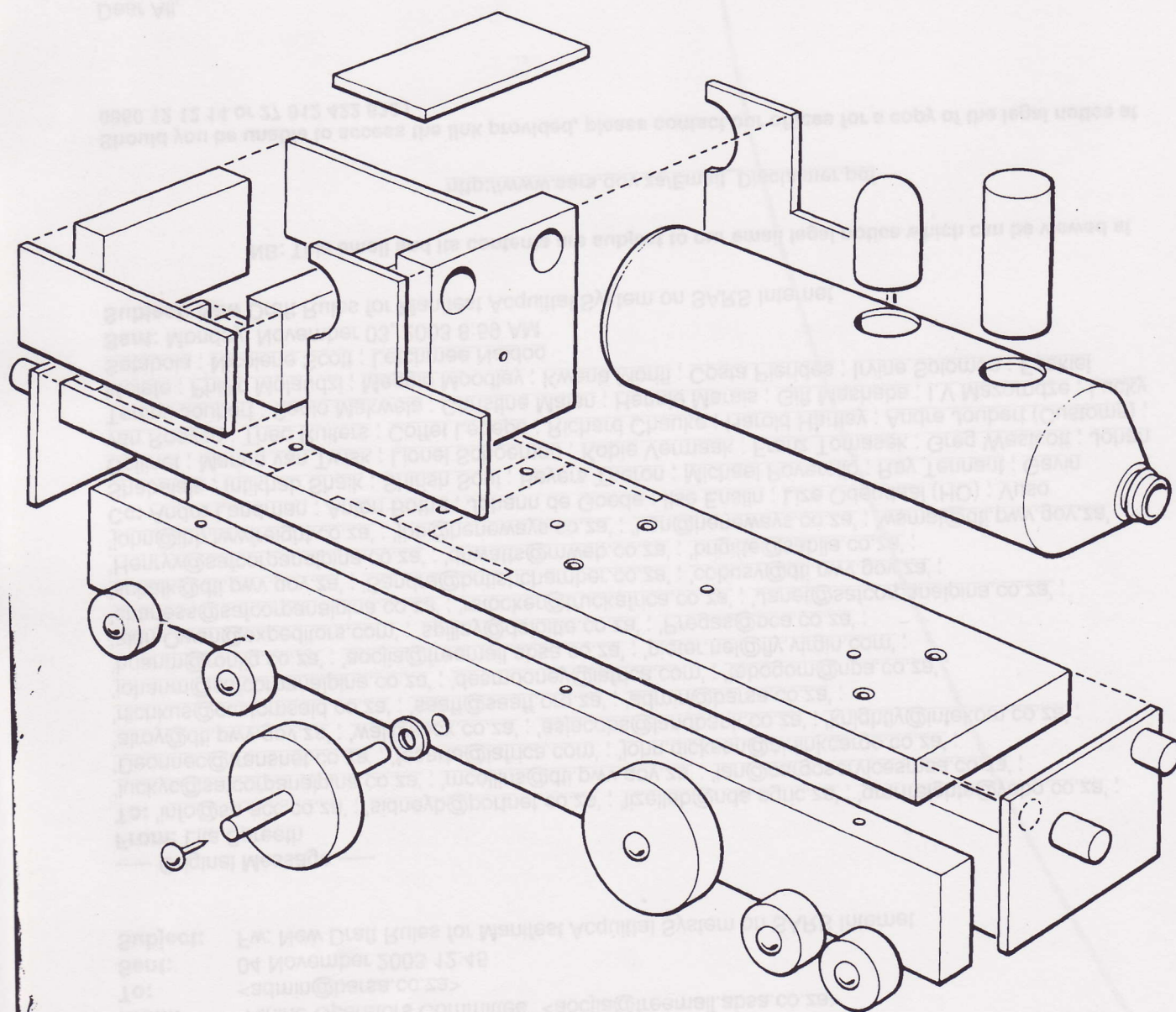
Following measurements in fig. 1, mark and cut out two wheel chassis. Mark and drill the two 6mm ($\frac{1}{4}$ in) holes in each wheel chassis section. These must be carefully positioned as they carry the axles of the drive wheels.

On cab front mark and drill two 19mm ($\frac{3}{4}$ in) holes and one 2mm ($\frac{5}{64}$ in) hole as shown.

Plane and sand all softwood parts.

Following measurements in fig. 2 mark out 6mm ($\frac{1}{4}$ in) plywood and cut two tender side plates, two base end plates, one cab roof and two cab

ASSEMBLING THE RAILWAY ENGINE



sides. Use a fretsaw to cut the curves of the cab sides. Sand all plywood pieces smooth.

Cut wheels from 12mm ($\frac{1}{2}$ in) plywood. Using a hole saw, cut four 6.4cm ($2\frac{1}{2}$ in) diameter circles and finish to 5.8cm ($2\frac{1}{4}$ in). Cut eight circles to an initial diameter of 3.2cm ($1\frac{1}{4}$ in), and finish to 2.9cm ($1\frac{1}{8}$ in). Drill 6mm ($\frac{1}{4}$ in) centre holes in all wheels (see Techniques section).

Note: If you do not have a hole saw, use a fretsaw for wheels, marking circles with compasses. Drill the 6mm ($\frac{1}{4}$ in) centre holes before cutting out wheels. Smooth edges with sandpaper.

From 2.5cm (1in) dowel, cut 7cm ($2\frac{3}{4}$ in) length for stack and 5cm (2in) length for dome. Sand top of dome to rounded shape.

Cut four buffers, each 15mm ($\frac{5}{8}$ in) long from 12mm ($\frac{1}{2}$ in) dowel. Sand and smooth.

Cut six axles, each 8.6cm ($3\frac{3}{8}$ in) long from 6mm ($\frac{1}{4}$ in) dowel.

Using two 3.8cm ($1\frac{1}{2}$ in) No. 6 (3.6mm) countersunk woodscrews and PVA woodworking adhesive, glue and screw the cab front to the base, inserting screws through holes marked C in fig. 1. Attach tender

end plates in the same way, using holes marked D in fig. 1.

Using 3.8cm ($1\frac{1}{2}$ in) No. 6 (3.6mm) screws and PVA woodworking adhesive, glue and screw chassis sections to base. Make sure that axle holes in each are aligned, and that the front axle is 14.5cm ($5\frac{3}{4}$ in) from the front of the base as shown in fig. 1.

Position boiler on base and hold in place with a 4.5cm ($1\frac{3}{4}$ in) long No. 6 screw through the front of cab. Turn assembly over and screw boiler to base using three 4.5cm ($1\frac{3}{4}$ in) long No. 6 screws inserted through holes marked B in fig. 1. Make sure that the boiler remains central while the screws are inserted.

Fit cap of detergent bottle onto neck.

Using PVA woodworking adhesive, glue stack and dome into the holes in the boiler.

Using 12mm ($\frac{1}{2}$ in) panel pins and PVA adhesive, glue and pin cab sides to base and cab front. Attach tender side plates and roof in the same way.

Before attaching the larger drive wheels, check that the axles revolve freely in the 6mm ($\frac{1}{4}$ in) holes drilled

in the chassis sections. If the axle stick, rub down with glasspaper.

Cut twelve plastic washers to fit between the wheels and chassis sections. Cut these from discarded plastic lids.

To attach drive wheels, turn engine upside down and inset two axles into previously drilled holes in chassis. Thread a plastic washer through each end of axle and the coat dowel tips lightly with PVA adhesive. Press the four large drive wheels into position. Tap a brass upholstery nail into the end of each axle, taking care not to split the dowel. You may find it easier to drill a small hole for the nails first.

Glue the smaller wheels to the respective axles before attaching the engine, including plastic washer and finishing with upholstery nail as before.

Fix axles to chassis with electrical cable clips (fig. 3), replacing the nails with 15mm ($\frac{5}{8}$ in) long No. 6 screws. Position the front set of wheels 3cm ($1\frac{1}{8}$ in) and 7cm ($2\frac{3}{4}$ in) from the front of the chassis respectively. Lay each axle in place and fix with cable clips, one on each side of the axle in pairs (fig. 3). Attach the rear set of wheels in the same way placing them 3.5cm ($1\frac{3}{8}$ in) and 10.5cm ($4\frac{1}{8}$ in) from the rear of the chassis.

Painting

Sand all parts and paint with the colours of your choice.

Wagons

Various wagons can be constructed for the engine by using shortened versions of the base and chassis which should be reduced to 12.6cm (5in) in length. The other dimensions remain the same as for the engine. The wheels should be the same size as the smaller engine wheels and attached in the same way using electrical cable clips. The base can either be left as a flat-bed truck, or have sides and a roof added to form carriages and a guard's van. Tanker trucks can be made by screwing small plaster-filled bottles to the base of the truck in the same way as for the boiler engine.

3. The axles of the smaller wheels, fastened to the chassis with cable clips.

