CHAPTER 5

SPRAYING TECHNIQUE

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LIST OF ILLUSTRATIONS

General

1. It is highly important that the operator should understand not only the nature of the materials and the mechanism of the spray gun, but also the technique of spraying in order to attain that degree of skill and proficiency necessary to obtain good results without wasting time and material. The necessary skill is acquired by constant practice and therefore, where possible, the same personnel should be allocated to all such work on the Unit.

Cleanliness

2. Cleanliness in spraying is essential; cleanliness of the work; cleanliness of the equipment and personnel cleanliness. If the work is not correctly prepared and thoroughly clean, the material will not adhere to the surface and peeling will result. If the equipment is not clean, the spray gun will not operate efficiently, resulting in considerable waste of time and material; containers which have coagulated material round the stoppers will also cause wastage. The operator should also give attention to personnel cleanliness in keeping the hands free from grease and material.

Precautions

3. Precautions should be taken against the risk of fire and explosion, and references to this will be found in the Vol. II Leaflets of A.P.830, in addition to recommendations for the storage of dopes, enamels, thinners, etc. (see also A.P.957—R.A.F. Fire Manual).

4. Information will also be found on the use of respirators for use when spraying in the Vol. II leaflets of this publication.

5. Precautions should also be taken to ensure that the source of air pressure is regulated to the correct value required by the spray gun. It should be ascertained at least once daily that the cut-off valve operates at the safe working pressure when a compressor is being used. It should also be ensured that water and oil vapour condensation is drained from the air container, the filter and the pipe-lines.

5A. Lead paint should not be used for any spraying operation except in a special compartment. This compartment should be provided with an efficient exhaust draught, and should be so equipped as to render it unnecessary for the operator to stand between the exhaust fan and the article which is being sprayed.

Atomisation

6. When the spray gun is in operation a stream of air and material is projected from the nozzle of the spray gun and the flow is unbroken until it reaches the objective surface when it is immediately spread in all directions close to the contour of the surface. The deflected air moving over the surface has a certain depth relative to its speed of projection, and the higher the air speed the greater the depth. It is therefore evident that all the air projected from the gun cannot actually come in contact with the surface, because most of it forms a moving layer of air of some depth which acts to a certain extent as an air cushion.

7. The material emerging from the material nozzle is suspended in the air stream, atomised, and carried along to the objective surface. The air stream travels slightly faster than the particles of material, but as these have a greater density than the air, they develop a certain momentum which carries them through to the surface; particles that have become too finely atomised however quickly lose their momentum and, being unable to resist the influence of the air stream deflected by the objective surface, are dispersed without being deposited on the surface.

8. If an excessive amount of spray mist is formed during spraying then it is evidence of over-atomisation, which results in waste of material representing a loss in some instances of as much as 25 to 30 per cent.

9. The following three fundamental principles must always be observed:—

(i) Use the least possible amount of air pressure that will give correct atomisation consistent with the viscosity of the material being used.

(ii) Hold the gun pointing at right angles to the surface being sprayed at any given moment.

(iii) Hold the spray gun at the correct distance (6 to 10 in.) from the surface being sprayed throughout each stroke (see fig. 1).

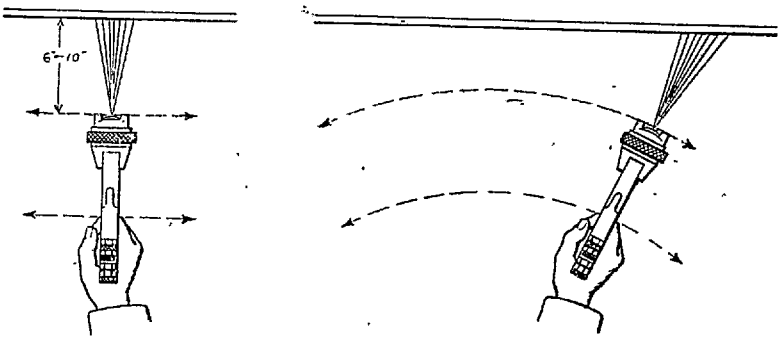

Fig. 1.—Holding the spray gun

Preparation of equipment for spraying operations

10. The following information applies to the general preparation for spraying, assuming that the gun is clean:—

(i) Select the correct material and thinners.

(ii) Strain the material and stir thoroughly.

(iii) Fill the container to a maximum of three-quarters full, or to a point that will leave a minimum in the container when the work is completed.

(iv) Ascertain that the following are of the correct size or are correctly adjusted:—

(*a*) Material valve needle to suit nozzle.

(*b*) Material nozzle—size varies for the type of feed and class of material; for example, viscous materials at high atomising pressures require a small nozzle; thin material applied at low atomising pressures will also require a small nozzle; large nozzles will be required for coarse materials.

(*c*) Spreader cap—size will depend on the volume of air and pressure available on the feed system used; on the type and volume of material to be sprayed; on the nozzle size selected, and on the size and nature of the work to be sprayed.

(*d*) Air valve.

(*e*) Trigger setting of both valves (air and material).

(*f*) Spray pattern (vertical or horizontal).

(*g*) Spray pattern width adjustment (when fitted).

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(v) See that the air hole in the syphon-cup lid is clear of obstruction or that the regulating valve in a pressure cup feed is closed before starting spraying.

(vi) Ensure that the compressed air supply is in order and the air filter drained.

(vii) Ensure that there is no leakage of air or material along the pipe-line, at the spreader cap or glands of the spray gun and at the container.

(viii) Check the atomising air pressure and, where a pressure feed tank is used, check also the material pressure. The latter will vary in direct ratio to the viscosity of the material in use

(ix) Mask all areas not requiring to be sprayed on the work.

(x) Obtain a respirator if the work is of sufficient duration to warrant its use.

Filling

11. In surfaces where there are lines of protruding rivet heads, countersunk screws or thin gaps between panels, these should be covered and smoothed off (prior to spraying) by means of a filler putty applied by a small thin-bladed putty knife. The putty should not be built up too heavily in one application but should be allowed to dry in successive layers; when dry the roughest parts can be smoothed down lightly with fine emery cloth. After the filling has been completed a priming coat should be applied and when this has dried the high spots should be flatted down using waterproof emery paper wrapped round a wooden hand block; plenty of water should be used to prevent the emery paper from becoming clogged.

12. In certain instances a line of rivet heads can be conveniently faired off by applying the filler and when it is dry a strip of thin canvas should be doped into position; another application of filler to fair off the strip followed by primer and flatting will complete the operation.

Procedure for retouching

13. When retouching damaged coatings, first obtain a good feathered edge by flatting the surface with emery paper, or, for very fine work—pumice, so that the edge of the coat of material cannot be detected by the sense of touch when the finger tips are passed lightly over it. Remove all traces of dust and grit with a clean duster, and remove any wax or grease by means of degreasing liquid (Stores Ref. 33B/510, 511, 512). Build up liberally with primer, extending in diminishing quantity beyond the feathered edges, then when dry rub down until level and smooth. Remove all dust or grit and apply finishing material; a mist coat of thinner will smooth out rough patches, after which apply the finishing coat.

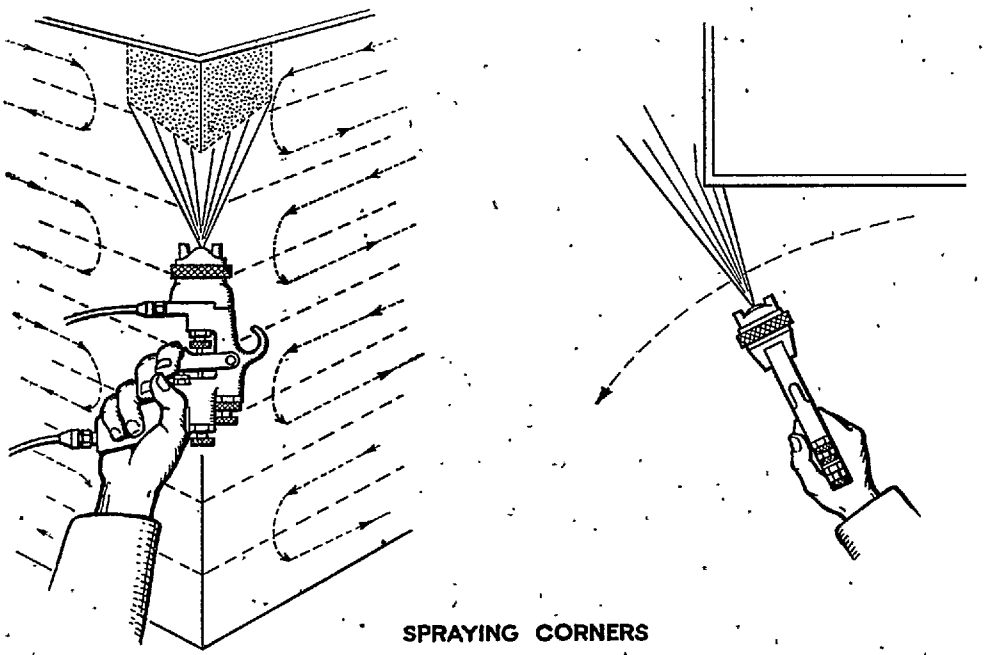

Fig. 2.—Spraying strokes

The operation of spraying

14. Assuming that all adjustments and preparation have been made correctly as already described, the actual handling of the spray gun is an art which is acquired by practice on the right lines. A good operator acquires a smooth even stroke, feathering off at the beginning and end of each stroke. The gun should be held square to the surface being sprayed throughout the entire stroke, and the operator must guard against the natural tendency to follow the arc of his arm reach, that is, by starting away from the work, swinging towards it and then pulling away at the end of the stroke (see fig. 1).

15. Before commencing to spray, the work should be carefully examined with a view to determining which way it can be sprayed by the least number of strokes; edges, recesses and protruding parts should be sprayed first so that the main surface will not be oversprayed. Corners should be sprayed to within one or two inches of the corner and then sprayed on the corner to include both sides at once (see fig. 2).

16. The spray gun should be triggered at the beginning and end of the stoke. At each end of the stroke the spray should be carried past the object being sprayed, but the trigger should be released at the point where it leaves the edge of the work. To pull the trigger back and keep it there for stroke after stroke is very wasteful of material.

17. During each successive stroke the spray gun should be pointed so that the centre of the spray follows the line along where the preceding stroke thinned off at the edge, thus ensuring even overlapping and a uniformly sprayed surface. The average arm-speed in spraying has been found to be 200/250 ft./min. Rapid or jerky strokes should be avoided.

18. Spraying must not be carried on to the point of fatigue, otherwise the work becomes erratic and causes loss of confidence which still further reduces efficiency, as good spraying is based on a self-confident mental attitude.

19. During spraying a good light is essential in order that the depth and condition of the sprayed material can be judged as it impinges on the work surface, whether it is over atomised, too thin or too heavy. Good lighting should be diffused and without glare and, for artificial lighting, fluorescent tubes are the best source of light.

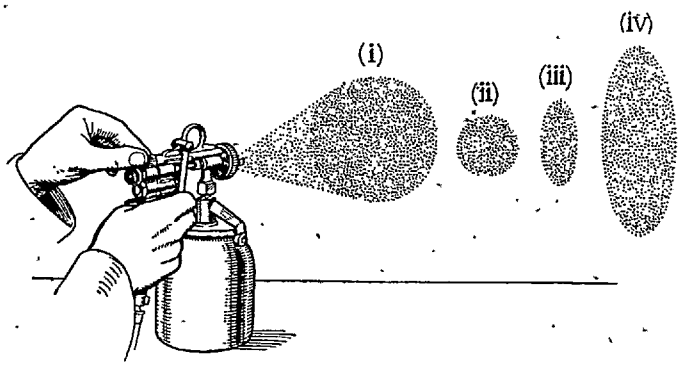

Fig. 3.—Types of spray patterns

Defective spray patterns

20. If the sprayed pattern is found to be defective, this can be caused by obstructions in the air holes in the spreader cap or in the air orifice in the centre of the cap. The atomisation may be incorrect, that is to say, the air and material not correctly balanced. The normal types of spray pattern are illustrated in the sketches in fig. 3 and the different types of imperfect patterns in fig. 4. The causes and effects are outlined in the following sub-paragraphs:—

(i) *Heavy top pattern* (see fig. 4 (i). Cause:—

(*a*) Spreader cap holes partially clogged.

(*b*) Obstruction on material needle tip.

(*c*) Foreign matter on spreader cap seat or material valve seat.

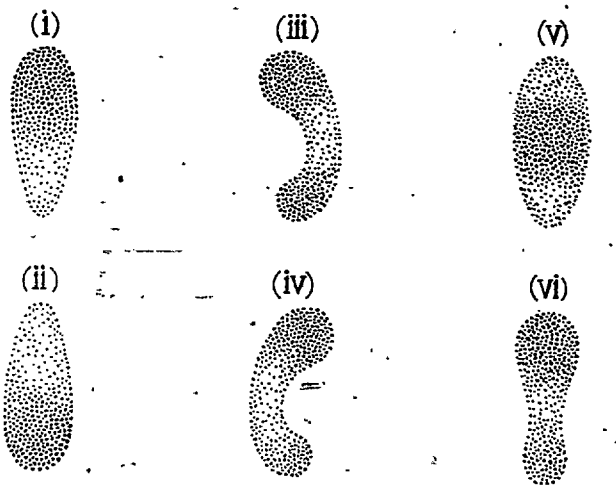

Fig. 4.—Defective spray patterns

(ii) *Heavy bottom pattern* (fig. 4 (ii)). Cause:—

(*a*) Spreader-cap holes partially clogged.

(*b*) Obstruction on lower side of material nozzle.

(*c*) Foreign matter on spreader-cap seat or material nozzle seat.

(iii) *Heavy right-hand pattern* (fig. 4 (iii)). Cause:—

(*a*) Right-hand spreader-cap hole partially clogged.

(*b*) Foreign matter on right-hand side of material nozzle.

(iv) *Heavy left-hand pattern* (fig. 4 (iv)). Cause:—

(*a*) Left side spreader-cap hole partially clogged.

(*b*) Foreign matter on left-hand side of material nozzle.

(v) *Heavy centre pattern* (fig. 4 (v)). Cause:—

(*a*) Too low a setting of spreader-adjustment valve.

(*b*) Too high a fluid pressure for the spreader cap's normal capacity of the material pressure-feed relative to the air pressure.

(*c*) Too large a nozzle for the material being used.

(vi) *Split spray pattern* (fig. 4 (vi). Cause:—

(*a*) Material and air feeds incorrectly balanced.

(*b*) Spray set too wide and material thin.

Note.—To determine whether the cause of a defective spray pattern is in the spreader cap or on the material nozzle rotate the cap one half turn and spray another pattern. If the defect is reversed the obstruction or cause is in the spreader cap; if the defect is not reversed the fault is in the material nozzle. Clean the spreader cap and check for fine burrs on the edge of the material nozzle or for dried material inside the opening. Check the air pressure and material pressure and adjust the spray-width till the desired spray is produced.

Orange peel effect

21. Orange peel effect (see fig. 5) may be attributable to one or more of the following causes:—

(i) Inferior quality of thinner or a thinner containing a high percentage of low boiling point solvent which will cause orange peel effect irrespective of efficiency of application.

(ii) The gun held too close to the surface, when the force of the air stream tends to disturb or ripple the surface.

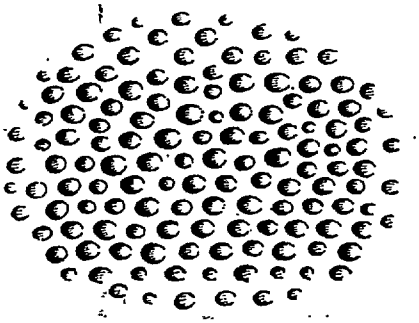

Fig. 5.—Orange peel effect

(iii) The gun held too far from the surface.

(iv) The material not thoroughly stirred and mixed.

(v) Currents of air in finishing room.

(vi) Incorrect relative humidity.

(vii) Insufficient atomisation caused by the air pressure being too low relative to the viscosity of the material. Multiple or larger orifices facilitate atomisation of heavy materials, but necessitate increased air flow to preserve the correct balance between air and material.

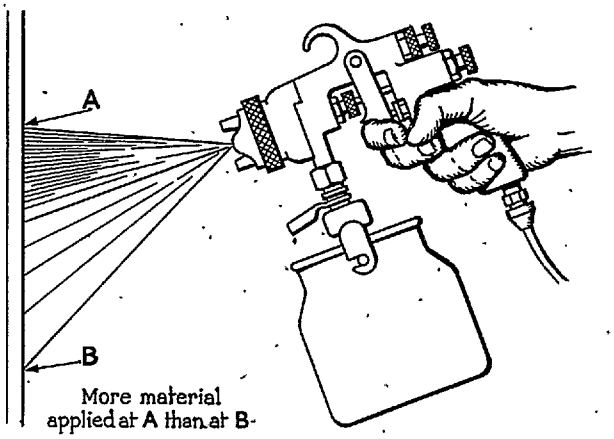

Fig. 6.—Tilting the gun

Streaks or runs

22. Streaks or runs in the coating may be caused as follows:—

(i) Tilting the gun (see fig. 6 and 7) and so spraying at an angle to the surface, causing the material to be unevenly applied with consequent waste.

(ii) Too much material applied to the surface. The speed of operation should either be increased or the fluid pressure reduced.

(iii) Runs are the result of the material being too thin.

Mist or fog

23. Mist or fog is due to over-atomisation and may be caused by any of the following conditions:—

(i) Too high an atomisation air pressure.
(ii) Incorrect size of spreader cap for the material being used.
(iii) Incorrect material nozzle for the material being used.
(iv) Material pressure too low (pressure feed tank).
(v) Spray gun held too far away from surface.

Jerky or fluttering spray

24. Jerky spray or fluttering may be caused by air leakage into the material line (see fig. 7) and may be due to any of the following causes:—

(i) Lack of sufficient material in the container.
(ii) Tipping the container at too acute an angle.
(iii) Obstructed material ducts.
(iv) Loose or cracked material tube in the cup.
(v) Loose material nozzle: dirty or damaged seat.
(vi) Material too heavy for suction feed.
(vii) Clogged air vent in the cup lid.
(viii) Loose or damaged coupling on the cup lid.
(ix) Loose needle-valve gland nut, or defective packing.

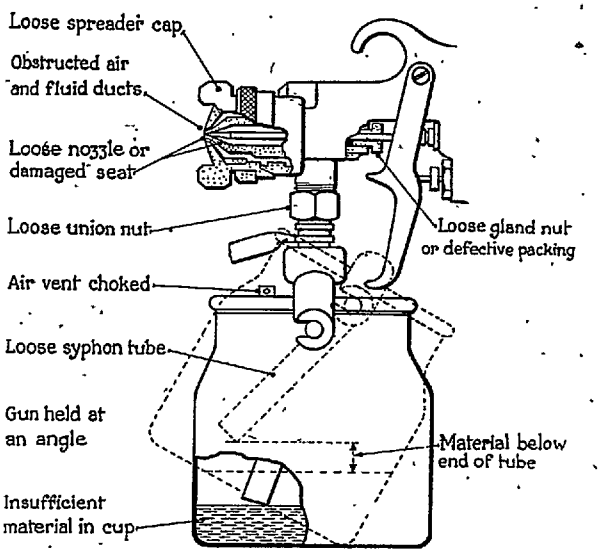

Fig. 7.—Causes of jerky or fluttering spray