FACTORY FINISH FOR LABELS AND

A problem which besets the home builder, the factory pre-production department, or the small manufacturer making a "one off" product, is to produce a unit which looks as well finished and attractive as its mass produced counterpart. This article discusses some of the materials and processes available to assist in solving this problem.

By LEO SIMPSON

Second only to its ability to perform as specified, the appearance of a piece of electronic equipment is its most important feature. In fact, on the consumer market, appliances are sold far more often on eye appeal than on technical performance. And, while the home constructor may have a greater appreciation of technical performance than the average person he should, if he has any pride in his workmanship, be just as conscious of the need for his projects to look attractive as to perform well.

The large-scale manufacturer has available a whole host of materials and processes to provide the appearance and finish he requires. He can use die-castings, engraved panels, extruded aluminium strip, plated metals, plastics and so on. However, the person who is making equipment on a small scale, such as the manufacturer with small production runs, the designer of prototype equipment or, again, the home constructor, cannot always use these because of the cost involved. One cannot specify an engraved aluminium panel for a "one-off" product unless cost is no object. This, then, is the problem that faces the latter group; how to obtain an acceptable appearance, particularly on control panels, with materials and processes that are available economically.

Fortunately the problem is not nearly as serious as it may appear at first or, indeed, as it really was a few years ago. Today the home constructor has available a variety of processes for finishing and labelling which are economical, reasonably simple to use, and capable of producing a really professional finish.

Paint has always been one of the most popular and widely used decorative finishes and is even more so today by reason of the wide variety of colours, surface, textures, drying characteristics etc., which are available. In addition, the advent of the aerosol paint can means that anyone can enjoy the benefits of spray painting without the need for expensive equipment.

In addition to the more conventional paint surfaces, such as matt, semi-gloss, full gloss, etc., there are various "textured" surfaces, such as "crackle," "wrinkle," "brocade," and so on. Some of these are still more suitable for mass production than single units, but others are now available which are ideally suited to the home constructor.

Crackle finish is a surface of randomly oriented fine lines that are produced in the paint base by a special overspray which contracts during drying. In general, this process is not very suitable for the home workshop but, in any case, is not a very popular finish even on a commercial basis.

Wrinkle is produced when the paint expands while drying. The increasing area of the paint film causes it to wrinkle, hence the name. These finishes are produced by baking in an oven although there are now available aerosol can paints which give a satisfactory wrinkle finish without baking. Brocade is similar to wrinkle, but the term is usually used to indicate a finer texture.

Hammertone is a high-gloss finish which appears as a hammered or "peened" effect. As produced commercially, it involves a baking process, although some attempts have been made to produce a non-baking version for home use. Unfortunately, these appear difficult to locate.

Clear lacquer is merely an overspray designed to protect the surface underneath, which may be polished, etched, brushed, or some similar finish which might otherwise tarnish.

All metal finishing processes require a scrupulously clean surface to begin with. Dirt, finger-marks and other grease-marks must be removed. This is best done with a detergent mixture, or a degreasing agent such as carbon tetrachloride, trichlorethylene, or other solvent. (Warning: These degreasing agents are toxic and should only be used in a well ventilated area.) If the surface is not free from all greases paint will not adhere properly.

When the surface is thoroughly clean it should be primed to ensure that the paint will adhere properly to the metal. Aluminium, in particular, should be prime coated, and one of the self etching type primers is recommended. Some paints packaged in aerosol cans can be applied to bare metal surfaces, but results are improved if a primer is used.

The best way to apply paint is in the form of a spray. A brushed surface is usually unacceptable. Paint may be sprayed using a simple hand spray similar to an insecticide spray, the rather more elaborate type of gun designed for use with a vacuum cleaner, or the professional type operating from a compressor. In addition, there are the aerosol cans which provide both the paint and the means to spray it for a moderate cost. All these methods are capable of good results.

It should be noted that paints are highly inflammable when in the atomised form. and that spraying should be conducted only in well-ventilated areas away from possible sparks or flames.

The ready availability of aluminium sheet has popularised the many textured metal finishes which are easily obtained on this metal. These include etching, brushing and anodising. Here is a brief outline of each of these processes.

Etched aluminium gives an attractive, fine-grained silvery finish, and is obtained by the action of caustic soda (sodium hydroxide). Four shallow containers which could typically be plastic wash bowls, are required for this process. The first contains a degreasing solution, or a detergent solution such as one would use for greasy dishes. The purpose is to remove the surface grease which would otherwise give uneven etching. Once the grease has been removed the metal should not be touched by hand. It should be suspended from a piece of string to facilitate handling or rubber gloves should be used.

Note that scratches must be removed before cleaning and etching. The scratches should be polished off with fine steel wool.

The etching solution consists, typically, of four ounces of caustic soda crystals to a half gallon of water. This will work satisfactorily at any temperature but for best results it should be hot — around 140°F. The third container contains water which is being continuously replenished by a hose connected to a tap. The aluminium is rinsed in this after being etched. It is essential to keep the rinse water clean, otherwise the aluminium may become streaky.

The fourth tray contains an acid solution and this part of the process can be varied to suit the particular case. During etching in the caustic solution the aluminium will become blackened to a degree, depending on the alloy used. This residue is removed by washing in an acid solution. If the blackening is mild a weak vinegar solution may suffice or, in more severe cases, a stronger solution of 50 per cent (by weight) nitric or chromic acid may be needed. The aluminium is finally rinsed in water and dried.

A special note is required on the use of acid. Use commonsense. Use rubber gloves and do not work in a confined space. Considerable heat is evolved when mixing acids with water. Water should never be added to strong acid solutions. Always add the acid to water, slowly. If water is added to a concentrated acid so much heat will be produced that steam may be generated, causing the solution to erupt violently, with disastrous results. To repeat, always add the acid slowly to the water.

It is important to have clean running water immediately available for flooding over the hands, face, etc., in case any of the caustic or acid solutions are accidentally spilt.

The etched finish is susceptible to fingermarks and should be given a coat of clear lacquer so that it can be

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handled. The above procedure is not rigid and can be varied to suit the requirements of the user.

Anodising is a more complex process than etching but it gives a more durable surface and it can also be coloured. Anodising is an electrochemical process in which the aluminium has a very thick oxide coating developed on the surface. The first steps of the procedure are the same as for etching.

After the aluminium has been etched and rinsed it is placed in a solution of 12-20 per cent (by weight) of sulphuric acid in distilled water. Any acid-resistant container such as a Pyrex dish or plastic wash bowl may be used for the acid. The aluminium is connected to the positive terminal of a variable DC power supply and a lead plate is connected to the negative terminal.

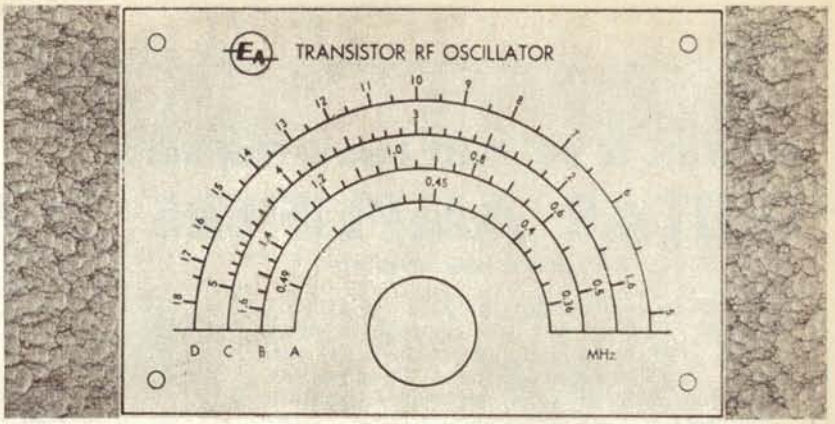
Care must be taken to ensure that the connections to either the aluminium workpiece or the lead plate do not introduce contaminating metals into the bath. The lead plate is best extended beyond the bath before connection is made to it. The workpiece may be suspended from an aluminium wire hook, or held in an improvised aluminium clamp. Alternatively, stainless steel photographic film clips may be used. However, lesser grades of stainless steel may not be suitable.

To enable the work to be done as quickly as possible the power supply should have a capacity of around 12 amps per square foot of the workpiece. Note that both sides of the work must be allowed for. If a piece of aluminium 4 x 10 inches was to be anodised, for example, the current would be adjusted for an overall surface area of 80 square inches, i.e., 6½ amps.

The current passing from the lead cathode through the acid electrolyte and the aluminium workpiece causes large amounts of oxygen to be evolved on the surface of the aluminium and this causes controlled oxidation to take place. The treatment time will take about 20 to 30 minutes depending on the thickness of the oxide coating required. This time is also dependent on the current flow. For values less than the 12A per square foot quoted longer times will be needed.

The oxide coating so formed is transparent and so the resulting finish is a velvety silver. Alternatively, advantage can be taken of the porosity of the oxide film to colour it with one of the many aniline dyes available. The anodised part is immersed in the dye solution for about 20 minutes. The temperature of the dye solution should be between 125 and 150°F The porous oxide surface must then be sealed by boiling the part in distilled or demineralised water. If the natural aluminium colour is desired the part should be boiled immediately after anodising.

Brushed aluminium is perhaps the most easily achieved finish. No chemicals are called for and the only equipment required is a standard wire brush



This label was made on Aluminex, in our workshop, using one of our own transparencies. It is mounted on a Hammertone finished panel with double sided adhesive film.

which can be obtained from any hardware store. Again, the aluminium must be scrupulously clean before brushing begins. The brushing process is merely a matter of making long parallel strokes with the brush in the direction required. Holding the aluminium can be a problem and this is best done by placing it on a horizontal wooden surface and securing it with a few panel pins to stop it from sliding around.

The "grain" of the resulting scratched surface can be varied by using fine or coarse wire brushes. Alternatively, a similar finish can be obtained with steel wool. The resulting finish is susceptible to finger stains and should be given a coat of clear lacquer before being handled.

While the above information will be useful in producing an acceptable finish on cases, front panels, and so on, there is still the problem of providing labels for the front panels.

One of the easiest approaches for the average constructor is to use "rub-on" lettering as sold under the brand names of Letraset and Instantype. This gives professional results and comes in a wide variety of lettering styles and colours. It is available from most stores specialising in drafting supplies and is supplied in sheets of individual letters or titles relevant to one particular subject, such as audio, amateur radio equipment, test equipment, etc.

Alternatively, one can use lettering guides and a pen of the Rapidograph type. This yields good results but the range of lettering styles is limited. In both cases the label must be given a coating of clear lacquer to protect the print.

A third approach to the problem of producing front panels and labels in small quantities has recently become possible with the introduction of new processes using photo - sensitised aluminium. One process has been developed by Graphtex Incorporated, 1 Dell Glen Avenue, Lodi, New Jersey, U.S.A. and represented in Australia by Luna Agencies and Distributing Company, 259 Jasper Road, McKinnon, Victoria.

The process uses Aluminex, a coloured, anodised aluminium from .003 to .125 inches thick which has a photosensitive etch resist on one side. This is exposed to light through a negative transparency. The opaque sections of the negative are reproduced as silvery aluminium and the clear sections in whatever colours the aluminium is supplied, such as black, red, blue, green or gold, in matt or gloss finish.

The process does not require the use of a darkroom, apart from the preparation of a suitable negative transparency, but the sheet should not be exposed to fluorescent lights or sunlight until final processing.

The three steps of the process are exposure, developing, and etching. The exposure is not critical, the important point being to ensure that it is adequate. Too little will give a washed-out result, but it is difficult to give too much. The light source can be sunlight, a No. 1 or No. 2 photoflood lamp, or the lights on a plan (blueprint or dyeline) copying machine, which are usually banks of fluorescent lamps or an arc lamp. It is essential that the transparency is in optical contact with the Aluminex and, ideally, has been so made that it is the right way round when the emulsion side is nearest the Aluminex. The label should be right way round, i.e., readable, as it is laid on the Aluminex.

After exposure the Aluminex must be developed. The developing is done with trichlorethylene or Graphtex developer. This softens the unexposed portions of the sheet so that it can be rinsed off with water. The developing is best done in a vertical tank to prevent contaminants from resting on the Aluminex coating. The tanks may be plain steel, stainless steel or aluminium, pyrex, or similar, or polyethylene. Rubber or those plastics based on

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polyvinyl chloride must not be used.

The processing steps are as follows:

(a) Immerse in developer for about 15 seconds.

(b) Immediately wash exposed side of sheet under the hardest stream of cold water available. This, before the developer evaporates from the sheet.

(c) Immerse in developer for 15 seconds again.

(d) Wash again as above.

These times are not critical provided the sheet has been exposed sufficiently. Care should be taken to see that the coated surface does not become scratched or scuffed. Once developed, the sheet may be exposed to any kind of light prior to etching.

After developing, an image should be visible. If the entire coating washes off during developing then the wrong side was exposed. With gloss Aluminex it is difficult for the inexperienced to determine which is the coated side; run a few drops of water on both sides of the sheet — the water will "wet" the uncoated side, but will run off the coated side as if it were an oily surface.

The etching can be done with a solution of caustic soda or Graphtex etchant. The solution is about 4oz of caustic soda crystals to a half-gallon of water. The etching time is not critical and may be varied within wide limits. The procedure is as follows:

(a) Immerse sheet in solution and wait until small flakes start to lift from the surface.

(b) Wait a further 10 seconds and then rinse front and back under running water as described above for the etching of ordinary aluminium.

(c) Wipe the front and rear to avoid water spots.

The thinner Aluminex material may be stuck to a clean metal surface using Graphtex double-sided adhesive film. An illustration in this article shows a sample label made from artwork for one of our projects.

A similar process to that by Graphtex is marketed by Minnesota Mining and Manufacturing (Australia) Pty. Ltd. under the trade-name "Scotchcal" photosensitive products. This is available in plastic or aluminium in red or black for the aluminium and red, blue, green and black for the plastic. Both materials are available in one thickness only and are supplied with a pressure-sensitive adhesive backing. Prices and other information regarding the process can be obtained from Ozapaper Sensitizers Pty. Ltd., 64-66 Chapel Street, Marrickville, N.S.W. or other distributors of Scotchcal products.

Basically, the Scotchcal process for making a label consists of exposure, developing and spray-finishing. The film is exposed with a negative transparency using a plan copying machine or photoflood lamps. The label is then developed with Scotchcal developer, which can be done in a normally lit room. Final step is to spray the label with a protective clear film. Fifteen minutes later the label can be pressed into position.

The negative transparency for these processes must be of high contrast, as must the artwork form which it is made, i.e., the artwork must have dense black lettering on a white background. Watercolour board makes a suitable background for the artwork. The lettering can be obtained in sheets in various styles and sizes or one can use print from glossy magazines or calendars or, as another alternative, use pens and lettering guides. Sheets of lettering and watercolour board can be obtained from all drafting supply stores.

Unless one has access to darkroom facilities the best way of obtaining a negative transparency is to have it made by a professional photographer. Alternatively one can make suitable transparencies without a camera using Scotchcal photosensitive film exposed in a plan copying machine or to photoflood lamps.

Finally, a transparency can be obtained without resorting to photograpic methods by using pens and letterguides on clear plastic film. This will result in silvery letters on a coloured background on the label.

So there it is — an outline of some of the processes available for obtaining a good finish on electronic equipment, whether home built or made in small quantities by equipment manufacturers. ■