Klaus-W. Voss

Casting with Polyester

Contents

Klaus-W. Voss

Casting with Polyester

Our clear resin (GTS) is not only suitable for your hobbies but also for use in advertising. For instance, gifts to customers and clients, paperweights, decorative pieces and other items can be made.

The personal touch can be achieved on important occasions — long service awards can be set in plastic.

Sales promotion with very important clients can be satisfactorily carried out. Just think for a minute: an embedded spark plug or ball bearing, a miniature car tyre, a radio tube or transistor and thousands of other industrial products are ideally suited to this purpose.

Vosschemie · Chemical factory

Technical consultation in processing techniques and application for cold-hardening and foaming preparations.

2082 Uetersen, Esinger Steinweg 50,
PO. Box 124 Telephone (0 41 22) 20 85 – 89
Telex: 02 18526

Branch offices in Germany and other countries.
All our materials are always in stock not only at the Uetersen factory, but also at our branch offices. You can save transport costs if you order from the branch nearest to you.

In Germany:

Berlin
Martin Luther & Voss K.G.
1 Berlin-Spandau,
Heerstraße 340
Telephone: (03 11) 3 68 51 53, 3 68 80 11-12

Düsseldorf
VOSSCHEMIE
403 Ratingen,
Felderhof 7
P.O. Box 1769
Telephone: (0 21 02) 2 30 81-83 <4 40 81-83>
Telex: 8 858 093

Rosenheim
Geier & Voss O.H.G.
8201 Kolbermoor,
An der Staatstraße
Telephone: (0 80 31) 92 48, 97 16-17
Telex: 0 525 799

other countries:

United Kingdom
Bondaglass-Voss
158–164 Ravenscroft Road
Beckenham – Kent
Telephone: (01) 778 0071/3

Belgium
Voss Belgium S.P.R.L.
Brussels 1090,
17, Chaussee de Dieleghem
Telephone: (02) 79 45 43

France
Soloplast S.A.R.L.
38, St. Egreve-Grenoble,
Av. de la Monta
Telephone: (76) 88 43 29 or 88 45 58

Holland
Romar-Voss K.G.
Roggel-Roermond,
Molenweg 20
Telephone: (0 47 49) 15 19

Austria
Voss & Makri K.G.
1120 Vienna
Ruckergasse 61
Telephone: (02 22) 85 51 31-32

Switzerland
Polyvoss AG
4004 Basle
St. Johannsvorstadt 98
Telephone: (0 61) 44 80 44
Telex: 62 134

Printers: Brunsdruck KG. Uetersen

No polishing is required due to the mirror finish of the moulds supplied with our casting kits. Seal the surface of the filled mould with Melinex sheeting and a perfect casting will result.

A simple mussel shell embedded in resin becomes an attractive and impressive decorative piece. This particular mussel was 20 cm long (8 in), the whole piece weighes 5 kgs (11 lbs).

Introduction

When on holiday at the seaside one often finds starfish, seashells and other interesting specimens which make subjects for casting resins. These fragile creatures greatly increase in beauty when embedded in resins. They make attractive paperweights, book-ends, lamp stands, settings for semi-precious stones, etc. They are eminently suitable as gifts for special occasions.

One often finds embedded specimens on display in schools, museums and for use in lessons. When objects are encapsulated in resins it enables them to be safely handled and examined.

Working with casting resin is not difficult at all so long as the instructions contained in this book are carefully followed. The book will give you the know-how to work successfully right from the start with this fascinating medium.

What is Casting Resin?

The correct technical term is unsaturated polyester resin. There are over one hundred different types of resins available but they are not all suitable for casting purposes. We have developed a specially modified resin for this application known as GTS. The TS stands for transparent and it results in an especially clear casting with an adjusted curing process to make application as easy as possible.

GTS resin is a thin syruppy liquid which cures at room temperature. It

This resin block was cast in the mould opposite. The mould is made of polythene and is especially well suited for this purpose. Rectangular moulds give interesting light refraction effects, because you see the embedded specimen twice if not three times when looking obliquely at it.

is specially blended with accelerators so only the addition of the liquid hardener is required to start the chemical reaction. The hardener is mixed with the resin in ratios of 0.6–2 % depending on the size of the moulding and temperature.

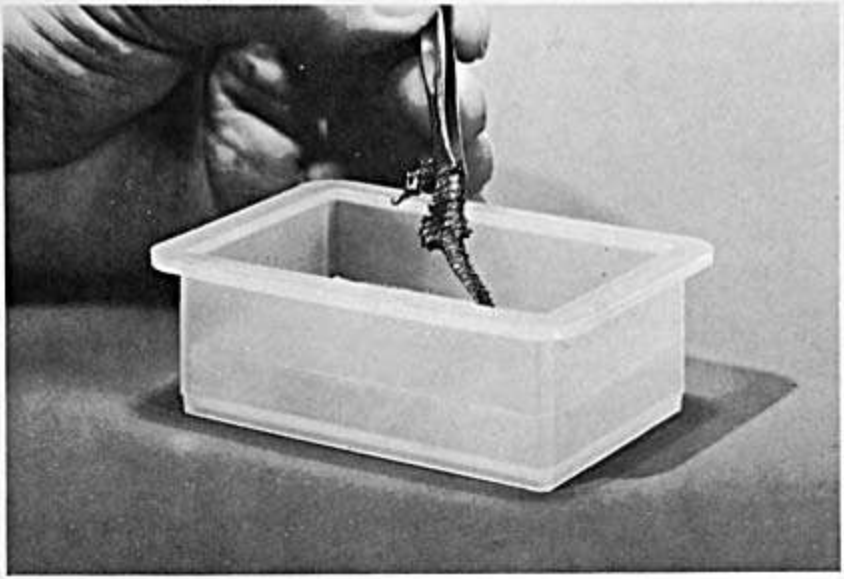
Casting resin has a pungent smell somewhat similar to coal gas. The smell comes from the styrene which is contained in the resin to a proportion of about 30 %. The styrene in its pure form is similar to petrol and during curing binds itself or cross-links to the resin's molecules. Polyester resins need a certain quantity of styrene in order to cure. The viscosity of resins can be lowered by the addition of up to, but no more than, 10 % styrene. This method, however, is not recommended for castings since pure styrene will shrink about 17 % during curing. If, therefore, 10 % is added an increased shrinkage of about 1.7 % would result in the moulding. Further, this additional shrinkage would produce tensions within the casting and the danger of cracks forming is increased.

Other types of polyester resins can, with certain reservations, be used for casting purposes but they will not have the extreme clarity of the GTS resin specially developed for this.

What can be used as a mould?

The mould, or container into which the resin is poured, must not have undercuts. It should not be larger at the base than at the top opening otherwise removal of the finished object when cured will be impossible. For example, a baking tin such as you use in cake making could cause a problem at the soldered joint. Vertical sides are certainly suitable since the casting resin block shrinks after curing by about 1–2 % in length. A conical mould would also be quite suitable.

Moulds best suited to this purpose are made from polythene (see above illustration). These are supplied in our kits and have been made to a high standard mirror finish. No release agent is needed with this material



since the resin will not adhere to it. Other suitable materials are

Glass
Sheet metal (polished or tinned)
Enamelled metal
China
Perspex.

With these items, mould release agent would be required.

Mould containers made of
wood,
paper and cardboard,
plastics,
fired clay (flowerpots).

Glass moulds are suitable only after trial or suitable preparation.

Glass plate cut into the appropriate size is quite suitable and the sections can be joined together with cellotape at the joins.

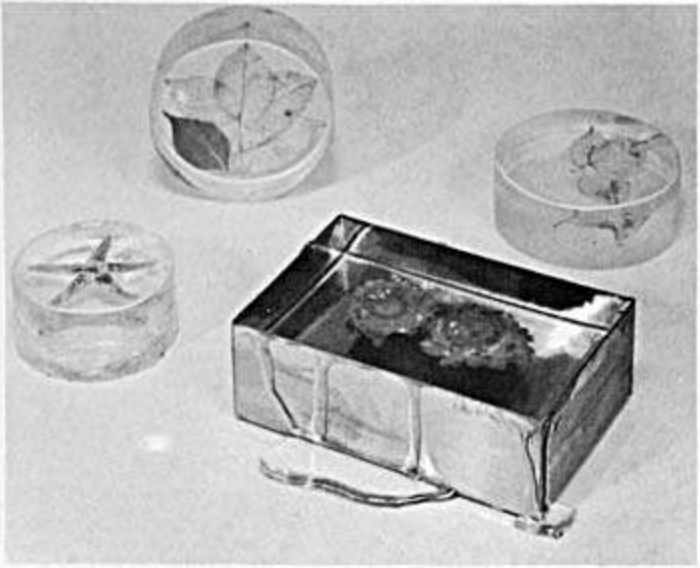
These are suitable for casting applications but a release wax is recommended or a good quality floor polish. If decorative or hammered finish glass is used, undercuts in the resin casting could result, but providing the glass moulding can be "knocked down" then no problem will result.

Tin Moulds

Cigarette boxes, cigar boxes or cake tins are often made of shiny thin metal sheet, the surface of which has been electrolitically tinned or has been galvanised. Tin of this type is also well suited. However, you must take care that these tins are not varnished on the inside, because the varnish could possibly be partially dissolved by the Polyester resin.

Enamelled Metal Moulds

Top quality enamelled ware is well suited for the purpose but as a pre-



In order that resin which has run over does not soil the table, it is advisable to put a polythene-sheet or a cardboard box underneath before starting. The lower mould is made of tin, but a normal cigar box made of wood or cardboard is also suitable.

cautionary measure a polish with a good quality wax is advisable.

China Moulds
China which has been glazed and fired is also satisfactory.

Perspex Moulds
This material is quite suitable since polyester resins do not adhere to the surface. For prolonged use however it is advisable to treat this material with release agent in order to ensure that removal can proceed with ease.

Wooden Moulds
Because of the porous nature of wood it is only suitable when the pores have been sealed. This can be done with many applications of wax polish or coatings of polyurethane paint. When using polyurethane paints, each coat should be flattened down with a fine sandpaper, 400–500 grit. This will in time give a smooth satin finish. Concave shapes made from plasticine will work quite satisfactorily but the following points should not be overlooked when using this material.

(a) Resins faithfully reproduce the surface onto which they are poured. The finish on your casting therefore will be dull and will require polishing. (b) The plasticine will not stick to the resin but the original shape may well become distorted in removal. This means that the moulding will in effect be "one off" only.

A useful tip: A suitable surface can be obtained by using aluminium foil, as used for cooking purposes, and this may be carefully folded to avoid creases onto a flat board. An interesting effect can be obtained if it is slightly crumbled to give light refraction to the casting.

These are the moulds wo have in stock. The material is Polythene (toughened).
1. Oval mould.
   Contents 0.5 kg
2. Rectangular mould.
   Contents 140 g
3. Round mould.
   Contents 85 g
4. Four small moulds.
   Contents 10 g

The inner sides are smooth, so that highly glossy mouldings result.
With a series of about 50 moulds you can set up a continuous production of specimens, because with the new GTS resin you can remove the cured resin block after only 2—3 hours. You can work without a release agent in these moulds, since polythene is self-releasing.

Plastic Moulds

Thermoplastic materials are only partly suitable, and they should be chosen with care to avoid disappointment.

Materials which are always suitable are:

polyethylene
polythene
P.V.C.
Epoxy resin
Polyurethene
Acetate sheet
Polyester-glassfibre
Silicone rubber

Unsuitable plastics are:

Polystyrene foam
Celluloid

In order to ascertain whether the medium you have chosen for a mould is suitable, a test may be made with a drop of acetone. If the acetone dissolves the material, it is not suitable for the process. Nail varnish remover will give the same results if acetone is not readily available.

Moulds made from glass-fibre/resin, glass-fibre/epoxy resin or polyurethane material are worth considering. With these materials moulds may be refilled and re-used many times. To make them it will of course be necessary to produce a master pattern over which these materials are laid up and allowed to set.

Flexible polyurethanes are of a special interest since their flexibility offers advantages over the rigid polyester or epoxy resin types for mouldings which may have undercuts.

For extremely complicated patterns, silicone rubber would be the best material.

Stamps, club insignia and medals are very suitable for embedding.

Adhesion to the mould — release agents

Polyester casting resin is by nature a bad adhesive on most materials. Moulds with a shiny and smooth surface without pores hardly need treatment with release agents in most cases, because the casting resin always shrinks after gelation and curing. The amount of shrinkage varies according to the speed of curing and highest temperature during curing. With Polyester resin you can reckon with a medium shrinkage of 7–9 %. This figure, however, indicates the shrinkage in volume, so that the measurable shrinkage in length corresponds to the cube root of 8, about 2 %.

Release varnish and release wax, have been proven by Polyester boat construction.

Our **release wax** is a hard wax, dissolved in Trichlorethylene. Release wax is applied with a brush or rag and can be polished after 2–3 minutes. You do not need to apply it thickly. Even after intense polishing the remaining film of wax is always sufficient as a release agent on smooth moulds. However, if the mould has a porous wooden surface, you should then apply release wax several times in order to close the pores completely.

Release varnish is a water-like liquid, Polyvinylalcohol based, which contains alcohol and water.

Release varnish is applied with a brush or sponge and dries in about half an hour. Release varnish can be removed again with hot water. Release varnish does not dissolve in solvents so that a film of this varnish

is not destroyed by the liquid Polyester resin.

Often floor polish for normal commercial usage is also sufficient as a release agent, but it must always be used as a last resort, since different types of floor polish contain ingredients which could unfavourably influence the curing of the resin.

Whenever both release agents are applied the order is first release wax, last release varnish.

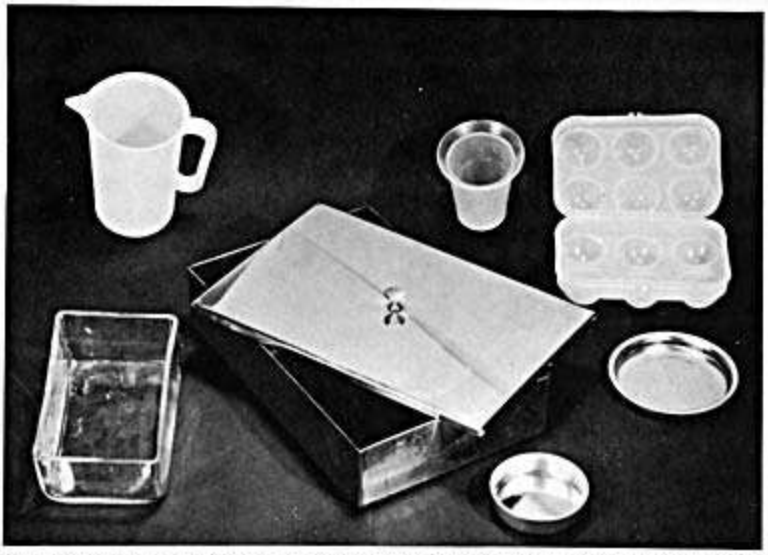
With normal metal, plastic or china moulds the best results are achieved by using the release varnish. Therefore for these materials release wax is not necessary.

The application of release wax to the surface can give streaks to the mould. These should be polished off.

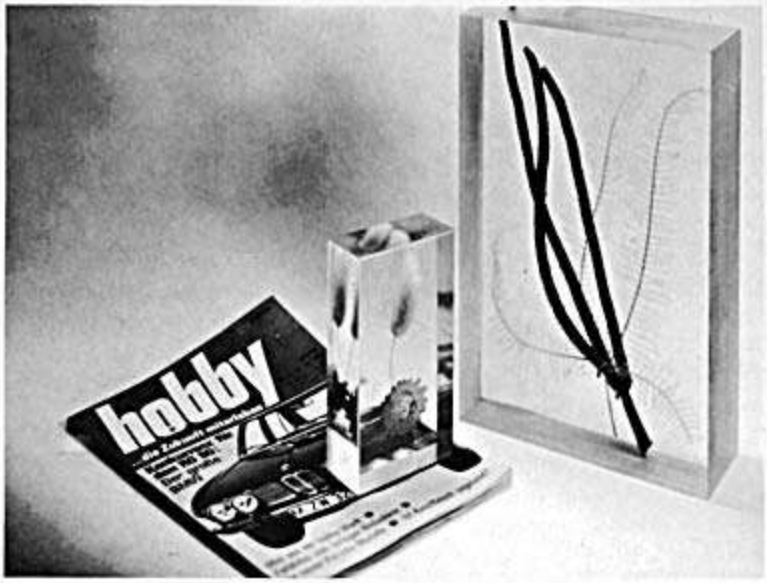
How large can a casting specimen be?

At an exhibition of synthetic materials in Dusseldorf, a whole seascape was displayed which consisted of a block measuring 9 feet long and 39 inches high and approximately 8 inches deep. This quite splendid masterpiece sold for several hundred pounds, proving that it is possible to produce large impressive castings from polyester casting resin.

The whole block weighed some 1,200 lbs. and from the material point alone was very expensive. Naturally the beginner would not attempt such a product. The small pendant moulds included with the kit are ideal to start with. They hold approximately 10 grammes (1/3 ounce) and therefore do not use too much resin at a time and the work is easier.



The lid of a tin box as well as the egg-box provide interesting moulds. A glass dish is often curved somewhat crookedly, whereas the metal box made of pressed tin gives very sharp-edged and straight contours.



Ferns, ears of corn and dehydrated flowers can be embedded, making charming combinations. The large block here measures 175 × 270 × 55 mm and weighs 3.2 kg. It was made in only 2 layers. The first layer was 0.5 kg GTS Resin, the second, therefore, 2.7 kg.

Casting resin is well known to be a bad conductor of heat and unfortunately has its difficulties.

During curing, heat will develop, this is called the exotherm, and is caused by the chemical reaction.

The heat generated increases with the quantity of resin used, because the heat is conducted very slowly to the outside. The hottest part therefore of the casting is always to be found in the centre of the moulding, and it is from this point that the danger of stress crack tension developing can occur. Due to the higher temperature in the middle, greater polymerization of the molecules occurs and with it a larger shrinkage takes place. In practice there is no limit to the size of such castings, provided that the rate at which heat is generated is successfully kept low, so that the critical tensions in the middle are minimised by slow curing. This can be achieved by casting and curing in several layers.

How does casting resin cure?

The resin has the characteristic of curing at room temperature after the addition of hardener. After thorough mixing with the colourless liquid hardener, and this should be done slowly to avoid air bubbles, the resin stays liquid for a while without the viscosity changing substantially. This period of time until gelation is called "the casting time". Gelation occurs without warning and at this stage the resin becomes thicker and jelly-like.

During gelation the molecules of the polyester resin bond together and this

An everlasting yellow flower always looks decorative as a paper weight. Even this round shape allows the flower to be seen twice, the lower image being enlarged.

causes heat to be given off. As the "jelly resin" turns hard, the temperature meanwhile still rises. It is advantageous to put the mould into cool water to keep the temperature from rising too high or too quickly. The highest temperature depends upon the reactivity of the resin. Resins used for glass fibre laminating are of this order. The types we recommend for embedding (GTS resins) have been produced specially for this purpose and are as slow in reactivity as possible.

After gelation, curing continues and the hardness increases with advancing polymerisation of the molecules. Since pre-shrinkage of the polyester resin is much intensified in the final phase of the curing process, this produces far more stress in the cured resin than in the still elastic or rubbery material. It is possible to interrupt the curing process for a time and also arrest further shrinkage by quick cooling in a refrigerator. By reintroducing to room temperature at a later stage the curing process continues until hardness is complete.

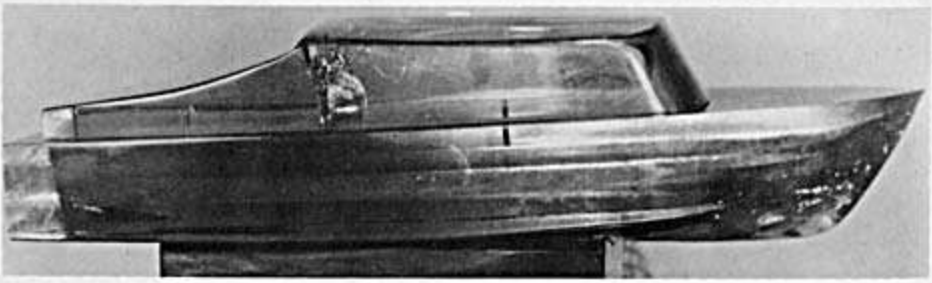
Our GTS resin is supplied already mixed with accelerator and this system guarantees perfect curing and minimises mistakes.

Which types of resin are suitable?

GTS resin has been formulated to give clear and bright castings. If, however, subjected to intense sunlight for considerable time, some slight change will be discernable.

It may be that an amber shade of resin is more desirable for certain work, and to this end our amber (AR) resin may be added. The mixing ratios and details are contained in a later chapter.

We manufacture and stock a whole range of different Polyester resins which are also suitable but have their limitations. The standard resin, which finds application mainly in mould building for boats and protective coat-



This boat is a metre long (40 in) and the individual layers can be seen clearly. During the casting process the mould was cooled in a basin of water. The cabin was made separately and fixed by two studs. The total weights was 68 kgs (150 lbs).

ings, is slightly yellow in colour, so that the transparency is somewhat impaired. This resin also cures quite hard and brittle, so that the danger of crack formation is greater.

Our almost amber – coloured resin is not mixed with MEK hardener as usual, but with BP hardener paste.

Amber resin contains an amine accelerator, so that curing is not possible with MEK hardener. We deliver this BP hardener paste in polythene or aluminium tubes. For potting resins (because of the transparency) you must use colourless BP hardener paste. This paste looks whitish to the eye, because it is in the form of an emulsion. When mixed with resin it is not visible after thorough stirring.

Pure amber (AR) resin would harden far too quickly, because with the addition of 2 % BP hardener paste it gells in about 5 minutes, and is completely cured after 15 minutes. With this rapid curing a large rise in temperature to about 200° C would result, mainly in the middle of the block, so that even smoke can rise from the cracks which form and a clearly darker colour becomes visible as a so-called core burning in the middle of the block. Therefore with normal castings you must always have a mixture of AR amber resin, about 20 parts to 80 parts of GTS resin, which is then cured with 2 parts of BP hardener paste, (all weight parts). This mixture then gells in about half an hour.

With the 80 % part of GTS resin, which contains cobalt accelerator, you can of course also let this mixture cure with 1 % MEK hardener. A slight yellowness is achieved with this, but only due to the yellowish colour of

AR. If you wish to get a strong yellowish amber – like colour this can only be achieved with BP hardener paste.

How quickly can you work?

The smaller the casting specimen is, the quicker you can work. Casting specimens the size of a bean, can be set very quickly using a 5 % ratio of MEK hardener, and they can be removed from the mould after 20 minutes.

Castings the size of a tennis ball must have a lower ration of MEK hardener, approximately 1 %, so that the later curing stage proceeds slowly. A casting of this size is not usually cured or removable from the mould until after four hours.

With potting blocks weighing 1 kg you should work in several layers. In order that the temperature of the first layer is again cooled down to room temperature, this layer must first be cured before continuing, otherwise the heat produced by the next layer would be added and reach still higher temperatures.

A resin block the size of a preserving pan (about 10 kg) can now be cast in one go with the new improved GTS potting resin, without core burnings, discolouring or cracks occuring.

Such a block after curing would get 2 mm of air all round at the mould sides due to the resin shrinking. It must be very strongly cooled from the outside immediately after gelation.

Our new transparent GTS resin makes possible resin castings of 20 kg or more in one go, without cracks forming, with the condition that no large cast pieces are embedded in the resin. A pure resin block containing no pieces can shrink evenly.

This fire-engine was embedded in one go, because at the bottom the wheels only give a very small visible point on the outside of the block. For long – service presentations e. g. for members of the fire service, such a block with an engraved dedication or an attached metal plate with a dedication is always fitting as a personal gift.

A metal object inside would hinder the shrinkage, so that the danger of a crack is very great. Therefore we recommend only taking about 40 mm (maximum) or less per layer when making blocks the size of a desk top. With such large deposits you should reduce the MEK hardener amount to 0.8 % and greatly cool the potting block after 20–30 minutes, i. e. after gelation has just begun. In winter you can simply put this piece outside or

in summer use the refrigerator, or, after 40 minutes, (after gelation is far enough advanced) simply use running water to cool. A further reduction in the amount of hardener and thus a slowing down of the curing is also possible, but this would produce a darkening in the resin.

Shrinkage

During the polymerisation process, gelation and cure, the molecules link up and move closer together, thus causing shrinkage.

At a later stage during the curing process, the shrinkage in a rigid mould can often be so great that the casting resin will loosen itself from the sides. If this does not occur, the resin when set may be heated in hot water to a temperature of about 60° F for 15 minutes. This will cause the resin casting to shrink a little, thus loosening itself from the mould. Shrinkage in length of about 2 % means that a 10 cm (3 1/8")mould shrinks by about 2 mm (1/8"). With rigid female moulds, i.e. the container into which the resin is poured, such as glass, these difficulties seldom arise.

To avoid tackiness on the surface of your casting, thus reducing unnecessary grinding and polishing, it is as well to fill the mould to the brim, so that the resin surface is just higher than the edge of the mould. Melinex sheeting as supplied in our kits can then be used to cover. Begin at one side and roll the sheeting very carefully on to the surface of the resin so that no air bubbles are enclosed. A metal plate, glass or aluminium foil, pre-waxed, may also be used. This tackiness is caused by the air which inhibits the exposed surface from completely curing.

Embedding a coin

Coins of every type are very suitable for embedding. They should first be highly polished to shine attractively when cast. If the coin is to lie in the centre of the resin block, first fill the mould half full with GTS resin mixed with the required portion of catalyst. When cured this layer forms a platform on which the coin can rest.

If however the coin is placed in position and the next layer of resin is poured over it, there is a danger that underneath the coin, air bubbles may exist which will not rise to the top. To overcome this pour about 10 mm of resin (3/8") onto the hardened layer and obliquely place the coin into position with tweezers. By moving the coin carefully, the smallest air bubbles may be released. Now gently pour the rest of the resin on and fill to the brim. Cover with the Melinex sheeting as mentioned in the preceeding chapter before gelation. After two to three hours the casting should have hardened and may be removed from the mould. Trim off any rough edges from the corners with a knife or with sandpaper.

It should be noted that using Melinex sheet on its own can cause the surface of the resin to become slightly curved or distorted. This may be avoided by placing on top of the melinex sheet a metal plate or piece of glass, first fixing this to the melinex with cellotape.

Violets cast in G.T.S. resin are ideal as gifts and mementos.

Colour variation during curing

GTS resin in its liquid state is slightly green in colour. With curing, this green colour disappears completely and a transparent resin block results. The change of colour occurs shortly before gelation of the resin and a definite lightening of the mixture about four to five minutes before gelation will be noticed. This marks the beginning of polymerisation.

Why cracks form

A solid specimen made of metal or stone surrounded by casting resin always resists the shrinkage of the resin so that cavities and cracks can occur on the surface of the embedded object. In the case of flat specimens with sharp corners, a maximum stress will occur at these points. Flexible objects such as dead animals or plants resist this shrinkage far less thus minimising the danger.

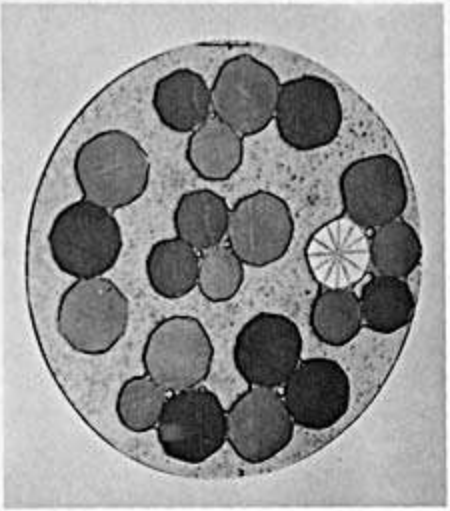
To overcome the problem with sharp edged objects it is helpful to encapsulate them first in casting resin in a smaller mould nearer to their exact size. However, by so encapsulating in a smaller mould it will be possible to notice the join when this moulding is embedded in a larger moulding. See chapter on Casting in Several Layers.

Should plants be dehydrated?

If a small amount of water is mixed with casting resin, the resin will still cure, but a whitish discolouration or streakiness occurs. Plants always contain a small amount of moisture. Organic ingredients in contact with moisture are decomposed in the embedded state by plant organisms or at least change in colour. Therefore it is recommended to dehydrate plants of every type. The colour of flowers and plants always change after embedding due to the effect of the peroxide in the hardener. The full glowing colour of a natural flower cannot be preserved for posterity unless subjected to quite involved treatment.

How can air-bubbles be removed from plants?

The fine shoots of dehydrated plants and herbs always contain air. Such an air bubble will be seen in the finished casting due to light refraction. It is well worth making the air



This mobile is suspended by a thin thread and three or four multicoloured discs provide an artistic and attractive decoration.

bubble rise to the surface and this can be achieved by twisting the plant round several times in the resin so that the air bubble may rise. Alternatively the plant, object or insect, may be dipped in styrene. This helps to release surface tension and allows the bubbles to rise.

Bubbles may of course be released by placing the mould into an airtight container and applying a vacuum. This method is unlikely to be available to the amateur, so extra care must be taken on the lines suggested.

For scientific potting applications the vacuum method is often used.

Preservation of animals

For many years schools and hospitals preserved animals or parts of the body in alcohol. The liquid, being inflammable, is always dangerous to children, and further, with the object being in liquid, it was difficult to turn or examine the object easily. By casting an animal in resin, this enables it to be carefully examined from all angles, and is of course completely hygenic.

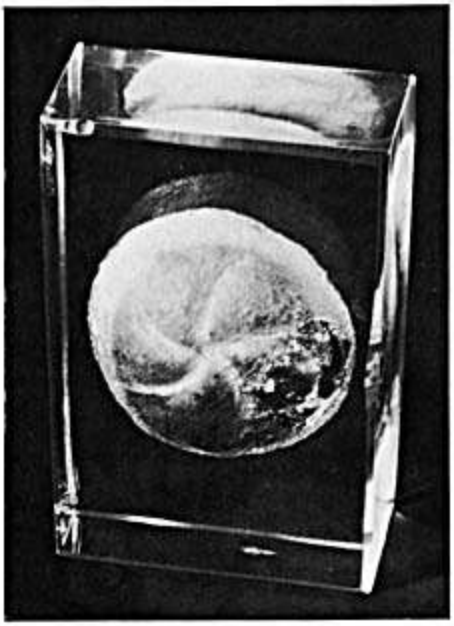
For this process the dead animal should be immersed in alcohol for several days to ensure complete saturation. It should be removed from the alcohol and dried on blotting paper for about ten or twenty minutes according to its size, before being put into the liquid casting resin.

Any alcohol remaining in the body is sufficient for lasting preservation. The alcohol will not damage cured polyester resin. The wall thickness of the resin around the animal should be at least two to three cm ($^3/_4$–$1^1/_4$").

Colour variation with organic dyes

A colourful butterfly or dragonfly make decorative subjects for casting. However these colours when immersed in casting resins can change. No hard and fast rule can be laid down as to what colours will remain fast. Certainly strong colours on the skins of animals will hardly show any visible change on contact with the polyester resin.

Covering the mould with foil should only take place shortly before gelation, because especially with plants and porous pieces, tiny air bubbles rise and burst on the surface all the time until shortly before gelation. If they do not do so, the bursting must be effected with a needle or a sharp object from the top before the foil or glass plate is laid on.



This embedded roll is suitable as a symbolic gift at bakers' presentations. On the righthand side you see quite a large air-bubble. During curing air continuously escapes due to heat; therefore this roll should be varnished several times first and you should only fill as far as the upper edge of the roll, so that the air bubbles can still escape to the top. After this layer has cured the rest must then be poured on.

Embedding in one go

In previous chapters it has been explained how to embed articles by first pouring in a layer of resin, allowing it to set and then placing the article onto the layer, finally pouring over more resin. This system can leave a faint detectable line where the two resins meet and may not suit the purist. Two alternative methods are suggested as follows.

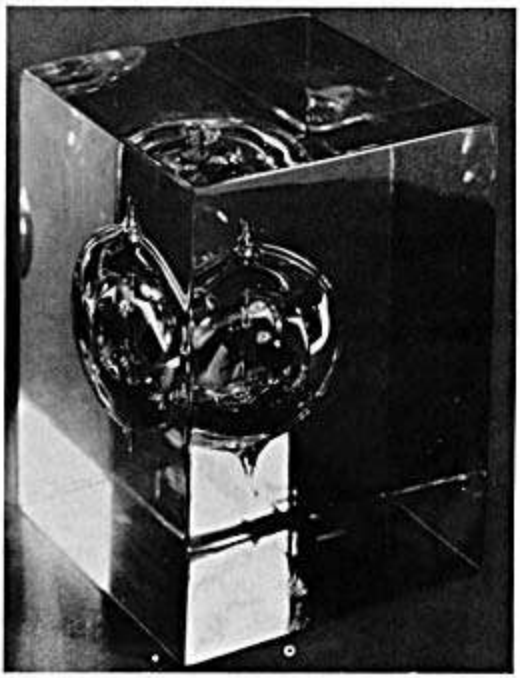
Firstly, having selected the article for embedding, decide whether it is lighter or heavier than resin. Lighter specimens such as flowers—seahorses, will float and therefore need to be fixed from below, heavier objects such as coins, medals, etc., will sink and need to be suspended from above. The suspension of an article can be done by using a fine filament of glass fibre taken from a piece of glass fibre cloth or roving. If it is not possible to tie the filament to the article the filament may be attached using a quick curing mix of resin.

The addition of a drop or so of accelerator to a small quantity of

resin will speed the curing time. When set the thread may be tied to a piece of wood which will sit across the top of the mould but ensure that the coin or object is central in the mould.

The resin after adding the hardener can either be poured into the mould before hanging the object, followed by lowering into the resin of the object, or the object may be suspended and the resin carefully poured around it. In following this method there are naturally difficulties in covering the resin surface. If the surface is to be covered by glass or metal then obviously a hole would need to be drilled through which the filament is passed, prior to tying onto the wood. If using Melinex sheeting, merely cut half-way across and slip it either side of the filament. The drilling or cutting will inevitably leave a mark on the surface of the resin which when finally cured will need polishing out. By this method only close examination will reveal the thread of glass fibre supporting the object.

Both black and white as well as colour photographs can be embedded in resin. The resin reduces the effect of ultra violet rays and this will reduce fading.



The appeal of all these objects, such as this light machine can be increased by embedding them in resin.

For insects and light articles the work must be carried out the opposite way to allow it to float like a buoy.

The second method does not utilise filaments of glass but does require constant supervision for the first stage. Pour the mixed resin into the mould to fill say half of it. The resin must be watched very carefully and gently prodded with a needle after about 10–15 minutes at 10–15 second intervals. The purpose of this is to detect when the resin is commencing to gel or become rubbery. As soon as this state is reached and it is unlikely that the object to be embedded will sink, it may then be positioned. More resin may then be poured in to fill the mould. For the second layer use slightly reduced catalyst content since the first layer will be producing heat and will be sufficient to assist the second layer to cure.

Casting resin GTS is a faint green in its liquid state. During curing it suddenly becomes transparent, shortly before gelation.

The method outlined can lead to disappointment and is very much a trial and error exercise but when successfully carried out will undoubtedly mystify people as to how an object could possibly be suspended in a liquid.

Casting in several layers

In practice it has proved successful to lay specimens for embedding on an initial layer of resin which has already cured. Plants and animals which are somewhat lighter than polyester resin would, as previously explained, float upwards in liquid resin.

They must therefore be anchored onto this first layer. A few drops of GTS resin is sufficient and to this very small amount of resin 1 % cobalt accelerator should be added and the amount of hardener increased to 3–4 %.

After approximately 10 minutes the drops will have cured holding down the object and then the subsequent layers may then be carefully poured in and around. For academic interest casting resins have a specific gravity of about 1.1 therefore it is 10 % heavier than water. Objects which will float on water will in consequence have 10 % more buoyancy in resin.

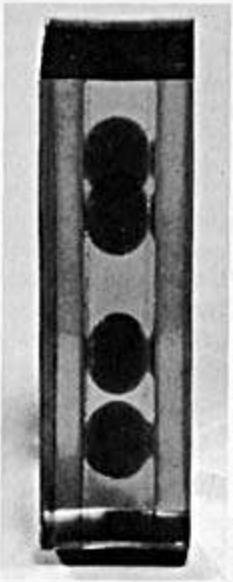
With larger mould pieces it is necessary to work in several layers in order to keep the temperature created by the setting resins as low as possible.

If a block say the size of a cigar box is required the maximum layer thickness per process is four centimetres (1⅝ inch) according to our experience with GTS resins.

The next layer should not be cast until the temperature caused by the exotherm in the first layer has been given off otherwise the new layer cures far too quickly causing possible discolouring and cracking. A further problem can also occur if the casting shrinks within the mould due to fast curing. The second layer when poured over this will run between the sides of the mould and the casting and these runs when set will have to be ground and polished off.

To avoid this it is advantageous not to treat highly mirror finished polished metal moulds and glass moulds with release agent. Further quickly cool each separate layer after it has set with running cold water, taking care that the water is only introduced to the outside of the mould. This will stop early loosening of the resin from the mould and will save much troublesome time grinding and polishing later on.

As a guide, something the size of a cigar box will take about an hour to be cooled but smaller pieces approximately thirty minutes.



You can clearly see the light refraction of the 3 different layers. In the middle are glass marbles. You can complete the middle layer first and then the two side ones in one go, or the other way round.

Why does a plaque made of 2 layers bend?

The embedding of pictures or decorative wall plaques is generally carried out in two layers. The first layer gels and cures and shrinks in length while doing so. When the second layer cures it will also shrink but since the two layers adhere together the second layer contracts even more. Due to the natural flexibility of the resin, the first plate tends to arch in both directions becoming rounded in effect.

This difficulty can be avoided if you make a three layer plate in two goes. The first plate is removed from the moulding after curing and thoroughly cleaned free of all release agent where it has been in contact with the mould using a fine grade wet and dry paper. A further layer of mixed resin, say 1 cm thick is then poured into the mould and into this place some pre-set resin pieces to act as a support for your first plate which may now be positioned. Pour in a further amount of liquid resin to cover the plate and up to the required level.

The shrinkage tension which now occurs is evenly spread on both sides of the cured picture or plaque so that distortion will be minimised.

It is worth noting that with large blocks shrinkage in the middle of the block is always greater than at the side, due to the greater heat development in the middle.

How much hardener at what room temperature?

GTS resin is supplied ready for use mixed with cobalt accelerator and after an addition of 1 % MEK hardener the casting time of about 35 minutes at 18–20° C (65–70° F) is achieved. At a room temperature of 25° C (78° F) reduce the amount of hardener to 0.8 %.

At a temperature of 25° C. (68° F) and using a 2 % MEK hardener gelation would take about 15 minutes. A useful table is given at the back of the book.

With the faster curing reactions the danger exists that the temperature of the casting will rise too high, causing discolouration and cracks. The amount of hardener therefore, should always be calculated to give a casting time before gelling of at least 20 minutes.

From this it will be obvious that with room temperature and increased catalyst a quick reaction results and therefore conversely with lower temperatures and less hardener, a much longer curing time will result.

If the addition of cobalt accelerator is necessary, do not add more than 0.1 %. More than this will tend to tinge the casting pink. Without accurate measuring glasses a 0.1 % ratio is difficult to measure. As a guide for a half kilo (1.1 lbs) of resin 0.1 % cobalt equals ½ grm. Twenty drops from the bottle equals 1 grm. Ten drops equals ½ grm. This simple measuring system will also apply of course to MEK hardener.

As a guide the following will give users assistance in working out quantities requiered.

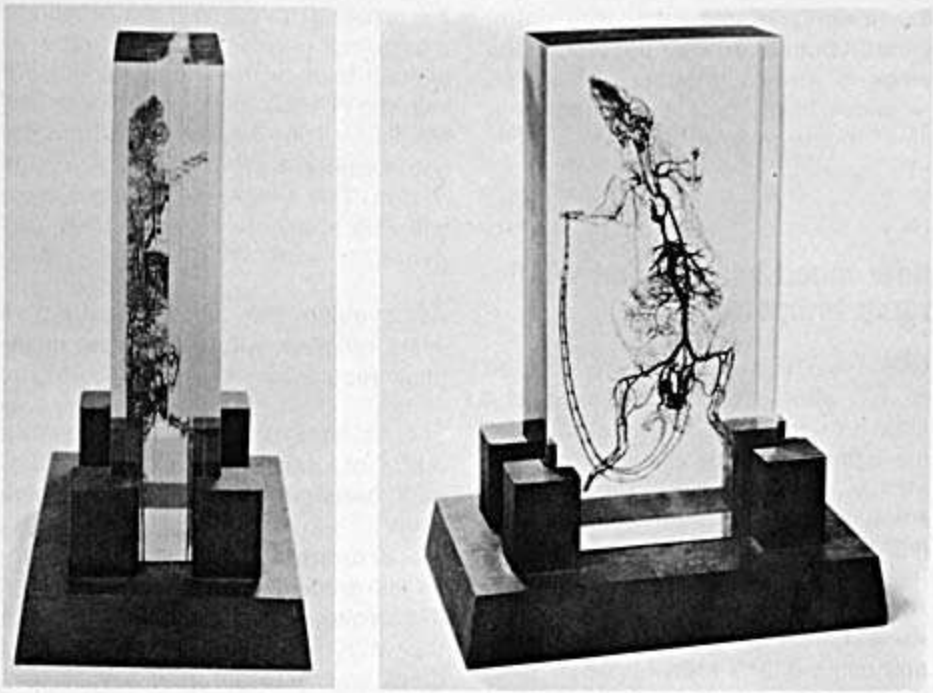
For ½ kg (1.1 lbs) resin, requiring 0.1 % of cobalt naphenate and 2 % MEK hardener add separately to the resin

10 drops (0.1 %) cobalt naphenate
200 drops (2 %) MEK hardener.

If a mistake is made when mixing in the MEK hardener and the casting block begins to gel after say 10 minutes, there is the danger of a high exotherm reaction resulting in discolouring and cracks. Quick action should be taken and the moulding should be put under cold running water to lower the temperature. Avoid the water entering the mould as this will turn the resin milky.

This action will also, as previously explained, minimise the shrinkage of the block so that it does not come away from the sides of the mould. A block of resin is generally finally cured after 3–6 hours. This can be accelerated by increasing the temperature in the room, although care should be exercised if it is increased too rapidly and again would cause cracking or discolouration.

For the best results do not polish or grind the casting block until it is cold.



This is the blood system of a rodent. The dead rodent's arterial system was filled with red epoxy resin while its veins were filled with blue resin. When the resin had hardened the whole animal was immersed in a potassium alkali solution so that only the blood system remained. This was then embedded in resin. It is an ideal method of preserving educational specimens.

If the resin is still rubbery or tacky the rubbing down papers will quickly clog.

In order to finish certain pieces very quickly we recommend heating for 20–30 minutes in the oven and then cooling them down to 0° in the fridge, because the block is harder when cold and can then be better ground and polished.

Quantities of hardener for large and small castings

GTS resin normally requires 1 % MEK hardener to give a gel time of 20–30 minutes. With larger castings from 1–10 kg (2.2–21 lbs) the hardener should be reduced to 0.8 %. Amounts over this 0.6 % hardener is sufficient. For small castings of 10–50 gms (½ oz to 2 ozs) the hardener cotent can be raised to a 2 % ratio.

For even quicker gelation up to 3 % of MEK hardener may be used if the amount of resin is between ½–1 oz.

This will give a very quick gelation cycle and the casting may well be removed from the moulding after only 45 minutes.

Embedding a 40 cm long crocodile

Prepared animals often contain wood shavings, cork powder or wood fibre, thus entrapping air. When embedding with resin the danger exists that during the curing cycle air will escape from the animal causing a bubble to rise. As the resin commences to gel, these bubbles will be trapped in the process and will mar the final effect. To avoid this, such an animal or specimen must be embedded in stages and the last stage being cast roughly to 1 mm above the highest point, in this case the jaw. When this layer has gelled a final layer may then be poured in.

A wooden box was constructed large enough to accommodate the animal and the box was then painted with two coats of polyurethane lacquer. When set the lacquer was lightly sanded down and given one coat of release wax, and one coat of release varnish.

For the lower layer on which the crocodile rests a white colour paste was added to the resin to give a better contrast to the body of the animal. This white base was roughly 15 mm (⅝ inch) thick and 1 kg (2.2 lbs) was used, mixed with 1 % MEK hardener (10 gms or 200 drops).

Gelation of this layer began after approximately 30 minutes and the final curing of this layer was complete after about three hours. Some shrinkage occurred due to the size of the project and the bottom plate freed itself from the sides by about 2 mm all round.

The crocodile was next positioned and fastened down with a small amount of resin so that it could not float upwards when more resin was poured onto it. Subsequent layers of resin each about 2 cm thick (⅝–¾ inch) were poured on and approximately three hours per layer was allowed. Due to the shrinkage which had occurred on the white base layer, resin ran down the sides into the gap. This resulted, when the block had finally cured, in fairly extensive grinding and polishing. The final layer was poured on to just above the upper edge of the mould and then a glass plate was carefully slid across the mould. When the complete casting had finally cured and cooled off it was found that the casting block had completely released itself from the mould and it was a simple matter to remove by turning it upside down. The block was then ground and polished (see chapter on grinding and polishing). The total weight for this very impressive and imposing casting was 5 kg (11 lbs) and the effect quite startling. Some later shrinkage after the polishing and grinding occurred causing the resin to free itself from the surface skin of the crocodile since it tends to shrink away slightly from the specimen, leaving a silvery shiny surface effect.

This is not paper in the middle of the block, but a crack. This block, which measures 30 by 20 by 10 cm, was cast with 20 mm for the first layer. Then the plant was laid in and all the remaining resin poured in in one go to a height of 8 cm. That was too much. With 2 × 4 cm it would not have happened.

Tinting with colour pastes

GTS casting resin may be tinted for special effects with PU-Colour paste. For the amount of resin equal to a cigar box, no more than a pinhead of colour is required to impart a tint without undue loss of clarity.

These colour pastes are available in 50 gm (2 oz) tins in the following shades –

Black, blue
Red, white, green, yellow.

These are all intermixable to produce other shades. To use solid colours for tinting casting resins will of course obliterate the clarity of the resin.

Special and attractive colour effects may be achieved in a variety of ways and the following is given as a suggestion.

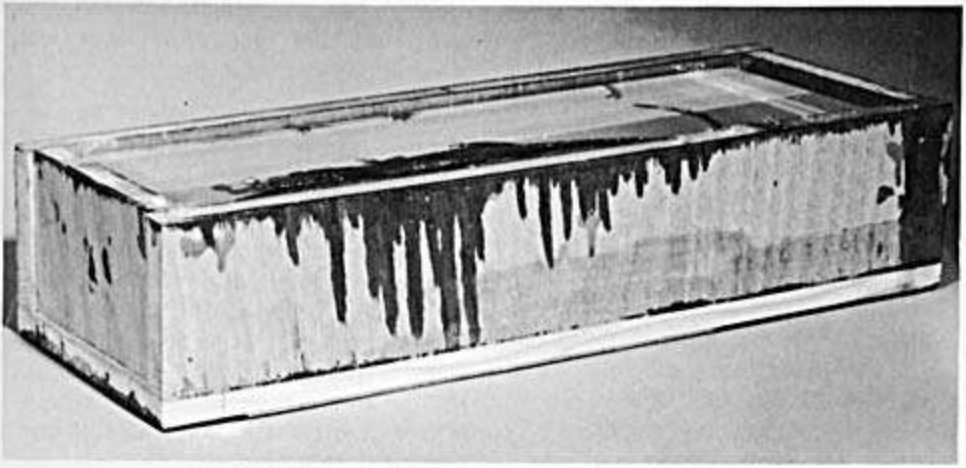
First make up a mixture of resin to which the hadener has been added, then mix in the PU-colour paste of choice in the ratio of 10 : 1. Add a few drops of the concentrate into the mould, which was filled with clear GTS-Resin + MEK-hardener before.

This colour concentrate may then be distributed with a match stick to form streaks. Obviously a variety of colours may be used for effect but take care not to swirl the colour too much to cause intermixing.

Other pleasing effects may be achieved by using different coloured resins and forming them in layers. Each one must be allowed to set before adding the next.

Alternatively try tilting the mould slightly and allowing the layer to set at an angle, then apply the next colour with the mould lying flat.

With care and thought a variety of effects are possible, only limited by the extent of the imagination.



A wooden box mould, in which the crocodile was embedded.

Amber resin AR

By adding 20 % of our AR resin to 80 % of GTS clear casting resin and curing with BP paste hardener, an exceptional likeness to amber will result. Such a mixture ratio may be cured with MEK hardener but the resultant colour will be lighter. To achieve various depths of amber the ratio given above may of course be varied. However, for larger castings it is recommended that no more than 7–10 % of the AR is added since it will develop more heat with possible cracking of the casting during curing. If using an AR/GTS mixture and BP paste hardener, work to a 2 % ratio of hardener for the entire quantity of resins mixed. The AR resin has a 'built in' amine base accelerator as opposed to the cobalt with GTS. It is known to be more reactive but by blending off with GTS this reactivity is reduced thus minimising the risk of high heat exotherms and cracking. Certain types of amber have a whitish cloudy appearance and this can be reproduced by the careful addition of white PU paste colour.

Gelation of pure AR with 2 % BP takes about 4 minutes at 20° C. This would mean that a great heat development occurs shortly afterwards due to rapid curing and such a block would have cracks.

Therefore the gelation and curing reaction must be slowed down by adding at least 50 % of GTS resin.

The clear yellow colour will be more strongly defined with a larger amount of AR but remember the larger the block, the smaller must be the amount of AR so that the heat development remains low.

Such a cured polyester block has almost the same electrostatic quality as

real amber i. e. it is charged when rubbed with wool, and will lift small pieces of paper. With correct colour tinting cast specimens closely resemble genuine amber.

Casting on to wood, ceramic tiles or metal

With most casting applications exists the problem of embedding pieces of wood. In wood pores there is always air or gas which only escapes very slowly. This escape would also continue after the resin has gelled, so that unwanted air bubbles would reveal themselves on the surface of the wood. You should therefore fill and close the wood pores first with resin, so that no further air can escape.

This can be achieved if first you first coat the wood with GTS resin plus 3 % hardener plus 0.3 % cobalt accelerator and wait until this layer has cured. The adhesion to the wood can be improved if you add 10–20 % Styrene to this resin.

This now far thinner liquid mixture then penetrates deeper into the wood pores.

According to the type of wood and size of the pores this preparation must possibly be repeated several times until all pores are completely closed.

In order to obtain the full effect of wood grain on the transparent casting, it is necessary that the casting resin bonds perfectly to the wood surface. If it were to loosen itself and a layer of air were to appear between the wood and the resin, this layer will look cloudy and unattractive.

This layer of air can indeed appear in the cured block because a certain amount of air is still to be found in the wood.

A development of gas can also occur due to fermentation inside the wood. With careful preparation and saturation this danger can be removed. Ceramic tiles do not need surface treatment. Metals and stones of all kinds are also suitable as potting specimens without preparation.

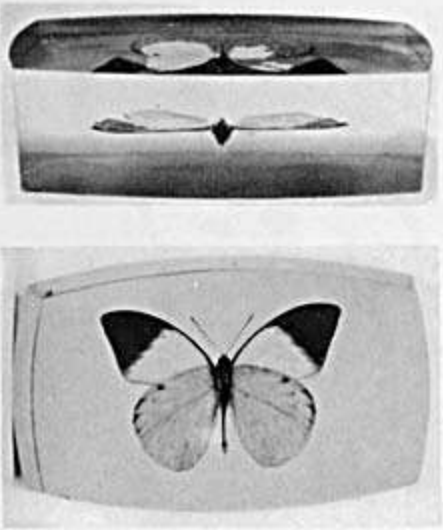
With larger ceramic tiles or metals you must bear in mind that on these relatively smooth surfaces there is poor adhesion of the polyester resin to the surface. It can very easily detach itself, because shrinkage tensions occur in the resin itself during curing. Even a detachment in part should be prevented if possible, because otherwise the brilliance of the colour could be affected.

Therefore ceramic tiles should be as small as possible so that the resin finds a hold in the gaps between each one.

Bonding cured polyester parts together

Polyester casting resin is well-known to be a poor adhesive. If you want to bond cured polyester resin to cured polyester resin, you must roughen it with coarse emery paper.

Even when making the surface rough with coarse emery paper difficulties can still arise, because both resin blocks will possibly shrink afterwards.



A blue first layer provided a contrasting background for this butterfly.

Then both parts would separate again by themselves. Broken blocks cannot be rebonded with resin to make an invisible joint.

Epoxy resins are suitable as adhesives for this purpose. They have the disadvantage, however, that they are always somewhat yellow in colour.

With Epoxy resin you can also stick cured polyester parts and metals, even glass or ceramics together, because epoxy resin does not shrink during curing and naturally possesses excellent qualities in its adhesion to nearly all materials. With our polyester primer Kakaplast – Cold Metal, cured polyester parts can be stuck as well. This material is not transparent because of the amount of mineral fillers. Rubbing up the surface, to achieve surface grip is recommended for all adhesion applications.

Removal from the mould

Firm moulds made of metal, glass or polyester resin seldom present difficulties, because in most cases the mould piece loosens itself to a certain extent, and is removed very easily by carefully tapping the embedded object.

If removal from the mould is still difficult, we recommend putting the whole piece for 10 minutes into a waterbath at about 40–60°, in order to reheat it.

An airing cupboard is also suitable. With the heat a further shrinkage of the resin block results, but allow it to cool down again.

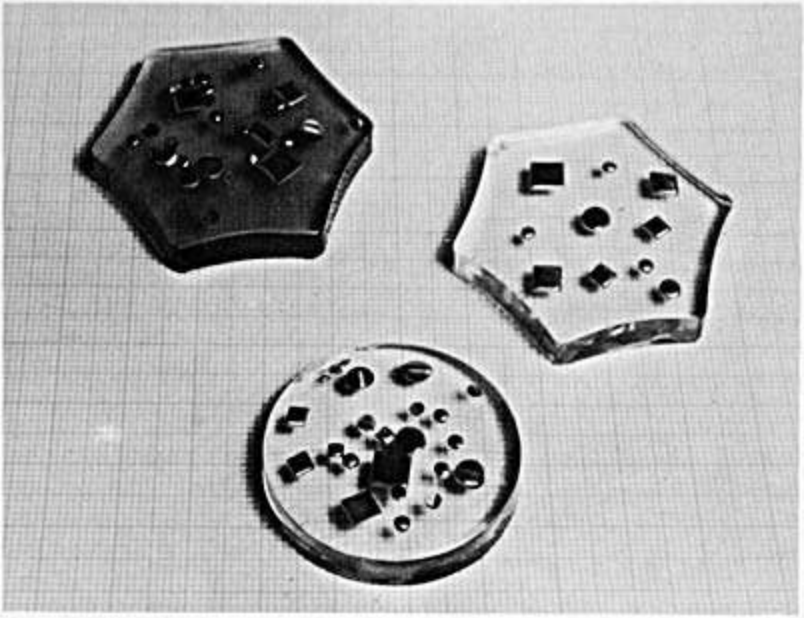
The expansion coefficient of polyester resin as opposed to iron is something like 6 : 1. That means it shrinks with cooling 6 times as much as the surrounding metal mould.

One can make use of this with difficult removals.

After reheating place everything in the fridge. This is definitely better than using force.

Turn flexible moulds made of polythene over and simply press from underneath on the cured block, difficulties seldom arise with this method.

For mould pieces with large undercuts you need flexible mould sides which can be bent backwards, so that the cured mould piece comes out.



Small bits of metal are very attractive as key fobs when embedded on a coloured base and are practical at the same time.

Our Silicone Rubber (cold hardening) is suitable, for this or our Hot Melting Mass (140° C).

Both materials are elastic and are capable of being stretched about 100 %.

Grinding and polishing a cast specimen

Casting resin does not fully cure on the surface exposed to the air. And therefore remains just a little tacky on this side. This surface tackiness is not always desirable, but it facilitates later bonding with the next layer. This tacky layer must be removed by grinding and polishing if the surface was not covered with a glass plate, a metal plate or Melinex sheeting after casting, so that the resin surface has no contact with the air during curing.

Since grinding and polishing is often very arduous, covering the final layer is therefore always worthwhile.

Removing protrusions causes less difficulties, because these can be removed with a knife or a file.

The ridges must be smoothed again afterwards with sand paper, so that a faint curve is formed along the edge. To grind a side you begin with medium fine sandpaper with a 120 grit. If you are dealing with especi-

ally large protrusions (several mm), you must first start with an even coarser grain of 60, which is quicker.

During the grinding process it is best to use a finer grain step by step, so that each time the grooves of the previous grinding disappear. A single deep groove makes it necessary to scrape out the whole surface to the depth of the groove, so that afterwards a completely smooth surface results.

Here an ash tray was used as a mould. The embedded pictures are cigar wrappers. Many other wrappers and labels are suitable for embedding.

The following grinding stages are necessary.

1. **Rough grinding and making the surface flat with 60 grain.**
2. **Removal of the rough grooves with 120 grain.**
3. **Removal of the previous grooves with 240 grain.**
4. **Removal of the previous finer grooves with 360–500 grain.**
5. **Removal of the last fine grooves with our grinding and polishing paste which we have especially developed for this purpose.**

Normal car-polish is not suitable for this. Use the so-called grinding-polishing paste, which mixed with grinding, mineral components has a slight abrasive effect on the surface. This polishing must also take place after removing any protrusions at the corners.

The sandpaper should be as wet as possible. The desired grains of water sandpaper are available at most ironmongers, certainly at any car accessory shop.

After grinding for a short time, the block and the sandpaper should be rinsed under running water, in order to wash away the loose grains from the sand paper.

In order to achieve a really smooth surface, we recommend fixing the sandpaper on to a piece of wood with a waterproof glue. The sandpaper must be laid over a flat piece of wood, so that the surface becomes completely smooth, otherwise any unevenness with pieces which are ground and highly polished will be clearly visible, due to light refraction.

Patience during the 5 stages of grinding will be rewarded by flawless brilli-

ance. Do not omit any of the 5 stages of grinding, otherwise the later brilliance will be spoilt by remaining scratches.

Boring, sawing, filing

Casting resin is only slightly harder than hard wood and can therefore be worked on with all types of wood tools.

When drilling do not use a normal wood drill, instead use a high speed drill, which must be well sharpened, so that no heat retention and cracks can appear (cool under running water if necessary).

For sawing, using fine-toothed saws such as a hacksaw.

Finer types are best when filing. The relatively coarse wooden tools easily cause chipping at the edges. The finer the saw teeth, the less will be the tendency for the edges to break.

Smoothly ground surfaces with a high-speed diamond cutting disc, may be obtained, but this is only worth while for continuous industrial use.

Making a mould with Silicone Rubber

There is often the problem of making a true – to life copy of a particular figure or relief. Silicone Rubber achieves this without effort.

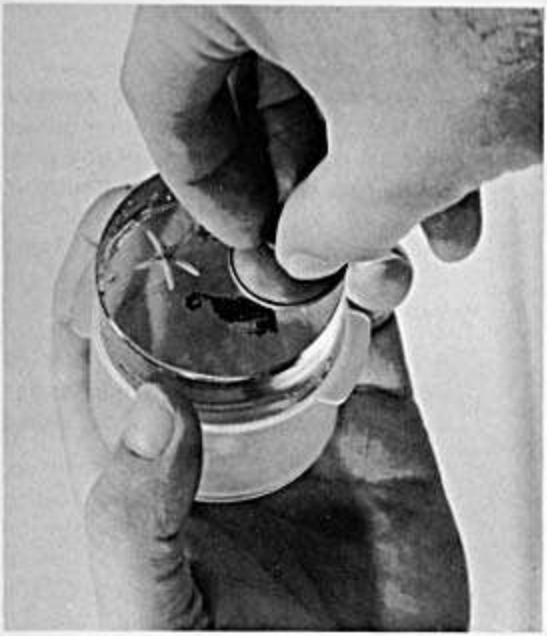
Silicone Rubber is a cold hardening, very elastic rubber, which, after adding hardener, turns from a liquid which can be poured, into a rubber-like, elastic mass within 3–4 hours. Silicone Rubber does not stick to smooth bases, so that no release agents will be needed. If a copy of a relief is required make a frame with strips of wood which must be higher than the highest points of the object to be copied.

A variety of amber shades can be created by mixing this resin with our normal G.T.S. resin. With this mixture you can use either M.E.K. or B.P. hardener.

Stir together the necessary amount of Silicone Rubber with the required 2% Silicone hardener and first paint a thin layer onto all highlights and cracks of the object to be copied, in order to be sure that no tiny air bubbles have remained in the hollows.

The whole amount of Silicone Rubber is then poured into the frame, until the object to be copied is covered.

After overnight curing remove the wood or metal frame and lift off the Silicone Rubber copy.



Here the cured mould piece is removed with a rubber suction pad. Careful tapping or strong cooling is always better than any type of force.

The mould is now turned over and filled with casting resin.

Use the wood or metal frame to support it. Silicone Rubber does not shrink during curing and reproduces all contours exactly to within $^1/_{10}$ mm. When embedding with resin we recommend first painting a fine layer of resin on to all uneven surfaces to exclude air bubbles.

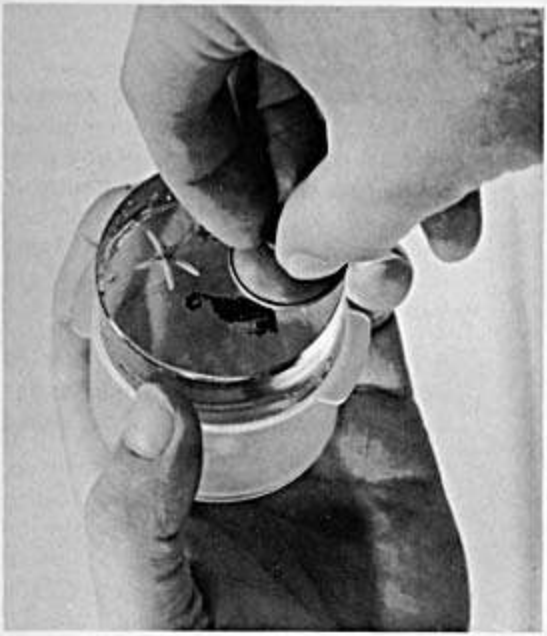
Due to its elasticity Silicone Rubber makes possible the casting of specimens with pronounced undercuts. If you want to embed whole chrysalides you can cut a silicone rubber mould open, make a hole at the top and, after joining, pour in from the top.

With a layer up to 5 cm thick a casting can be finished in this way in one go. The mould of silicone rubber can be used for at least 5–10 other castings, until it is attacked by the Styrene in the Polyester resin. If the mould is somewhat swollen after using several times due to slight penetration of Styrene, leave for 1–2 days and the mould is then fit for use again.

Making ornamental handles for glass doors

A large new field in the industrial production of casting resin pieces presents itself with the production of decorative handles.

Glass doors for shops, doctors and for any private person achieve an individual touch when decorated with a handle in which castings of professional emblems can be seen.



Here the cured mould piece is removed with a rubber suction pad. Careful tapping or strong cooling is always better than any type of force.

The mould is now turned over and filled with casting resin.

Use the wood or metal frame to support it. Silicone Rubber does not shrink during curing and reproduces all contours exactly to within $^1/_{10}$ mm. When embedding with resin we recommend first painting a fine layer of resin on to all uneven surfaces to exclude air bubbles.

Due to its elasticity Silicone Rubber makes possible the casting of specimens with pronounced undercuts. If you want to embed whole chrysalides you can cut a silicone rubber mould open, make a hole at the top and, after joining, pour in from the top.

With a layer up to 5 cm thick a casting can be finished in this way in one go. The mould of silicone rubber can be used for at least 5–10 other castings, until it is attacked by the Styrene in the Polyester resin. If the mould is somewhat swollen after using several times due to slight penetration of Styrene, leave for 1–2 days and the mould is then fit for use again.

Making ornamental handles for glass doors

A large new field in the industrial production of casting resin pieces presents itself with the production of decorative handles.

Glass doors for shops, doctors and for any private person achieve an individual touch when decorated with a handle in which castings of professional emblems can be seen.

For doctors a scalpel is suggested. The personal touch has hardly any limits in this way.

The composition of these professional symbols can be determined exactly beforehand when worked out in copper or silver wire.

Enamel compositions are also ideal for this.

With some imagination and the necessary creative artistry such compositions are often profitable, because they are individual productions.

Making plates with a crumpled effect

To replace broken decorative leaded light windows and to give a hammered effect to the casting if need be is relatively simple with G.T.S. resin.

A wooden frame of the right size, which has been rubbed with release wax, will do as a mould.

The uneven base is achieved by using aluminium foil.

A suitable piece of foil is thoroughly crumpled in the hand and then opened out again. Fix this foil with a few drawing pins to the wooden frame from underneath. For safety pull the foil up from the around the frame in order to be sure that no resin can escape because it always takes some time for the Polyester resin to gell.

Having filled this mould you would now have a plate which is crumpled on one side and completely smooth on the other.

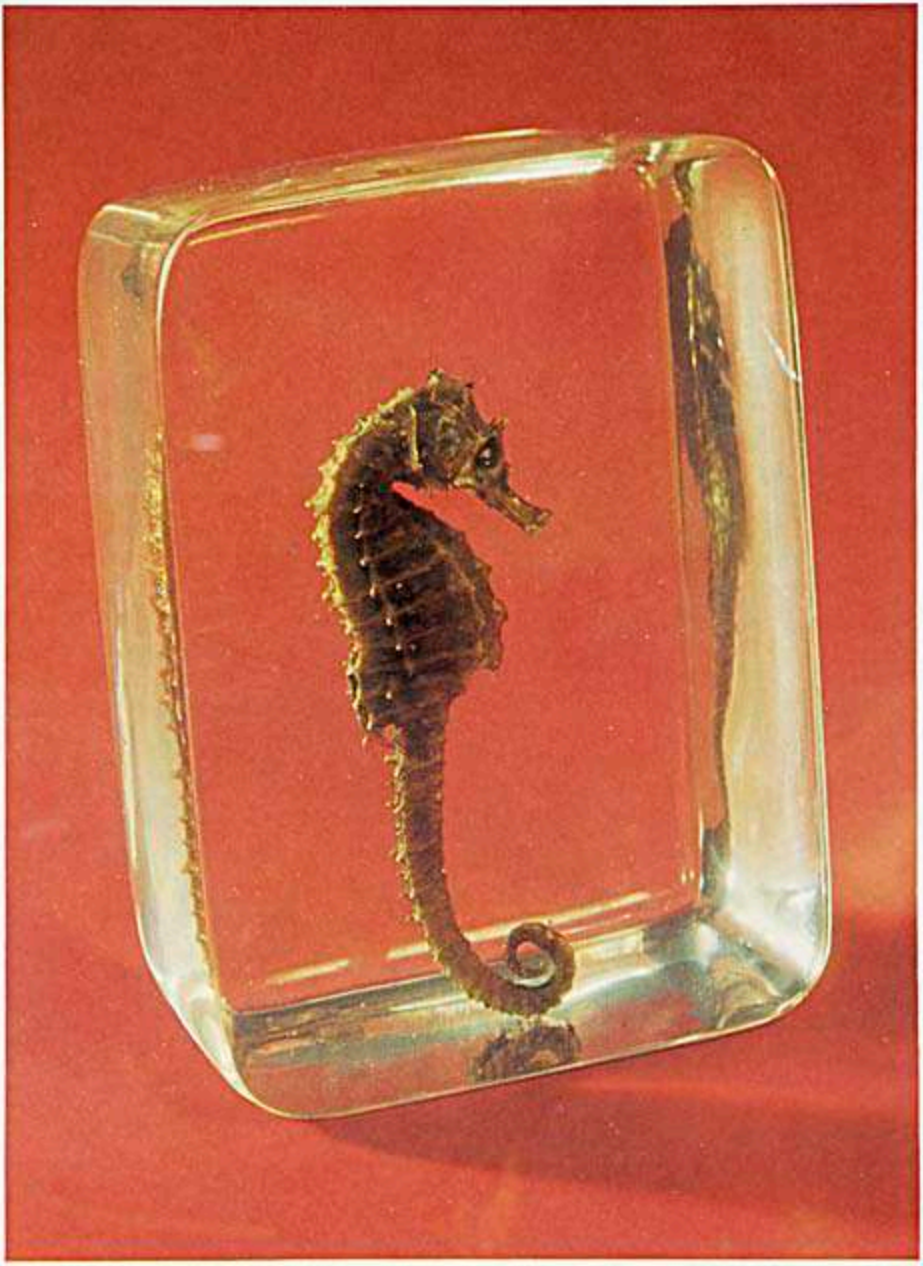
The surface of the resin remains somewhat softer during curing on the side which the air gets to. If you want to improve this surface, lay a suitable piece of aluminium foil or melinex sheeting carefully on to the liquid resin, so that no air bubbles are trapped (see page 28).

If the surface is to have a crumpled effect top, screw the foil into a ball flatten out and lay this over the resin.

If, however, crumpled foil is used, there is a danger of air bubbles being trapped in the hollows. Therefore the top foil should be stretched on a roller (round wooden rod) and this is then rolled out very slowly from the side, during which process a certain amount of resin is forced out, so that the air-bubbles are pressed out of the hollows. With a certain amount of skill, the plate cast in this way will be uneven on both sides and an especially decorative light effect is obtained. If such plates are to be strengthened against breakage, place some fine glass mat in the liquid resin at the appropriate layer thickness, and remove all air-bubbles from this by careful dabbing with a brush. A very faint fibre structure will be seen, however, due to the change of the light refraction index of glass and resin, which, often gives a special effect.

What sorts of things can you embed?

Using the correct method you can embed such objects in liquid Poly-



A sea-horse is a good-luck charm for many occasions.

ester resin which do not disintegrate in the resin.

Liquid Polyester resin contains Styrene. Therefore anything which is attacked or destroyed by Styrene is not suitable. There are not many materials and substances which cannot be embedded.

Here is a short list of objects which cannot be embedded:

Thermoplastic material made of Polystyrene, pressed casting pieces made of ABS (Acryl-Butadien Styrene), objects varnished with oil or nitro dye, fabrics with colours which are affected by Styrene.

Apart from these few exceptions we now list a few ideas for decorative potting specimens.

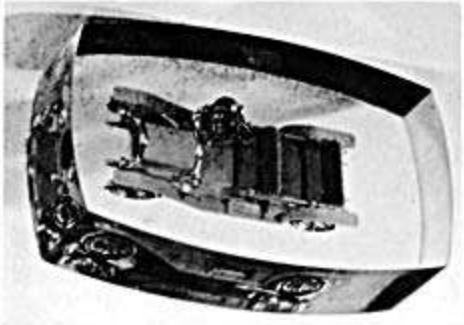
Sea-shells, dried star-fish, sea-horses, dried miniature turtles, also salamanders, non-dried animals treated with alcohol, butterflies, beetles, all types of insects, dehydrated flowers and grasses, all leaf plants, (always after dehydrating) printed, coloured paper eg. visiting cards, posters, all types of photographs, (colour or black and white) valuable souvenirs from relatives or friends.

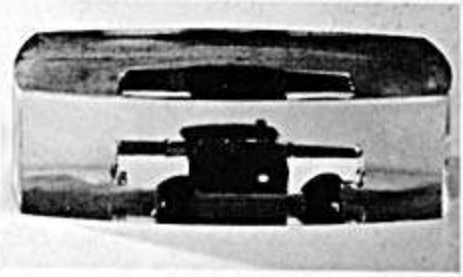
For advertising gifts:

Clocks in separate parts, ball-bearings or roller bearings, cog-wheels, all types of coins, stamps, Club badges, Medallions too are very good.

Miniature cars (true to type for the respective owner), model aeroplanes and gliders for enthusiasts of such things, engines and coaches – as paper weights – for the retirement of railway officials, miniature bowls and booby prizes for bowling clubs, tennis rackets and golf clubs, footballs for fans of all ages, small musical instruments (trumpets, violins etc.).

For every profession there are special symbols.





These Model cars can be potted in an ordinary wooden cigar box. In competitions this sort of thing is especially good for prizes.

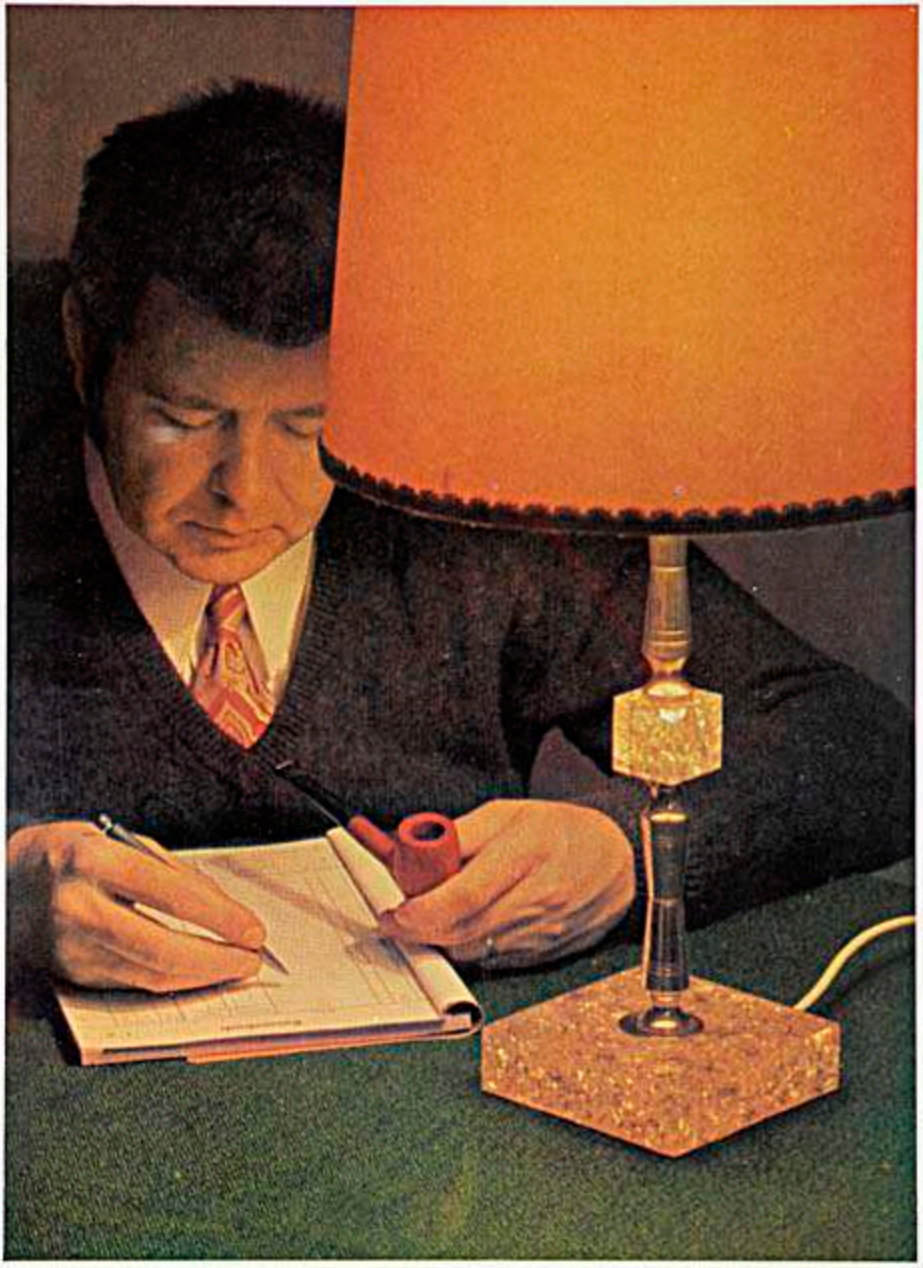
The middle mould was made from the original with Silicone Rubber. The top piece was potted in two layers, the first layer being coloured green.

For jubilees, birthdays, retirements and also firms' jubilees, these professional symbols, when embedded, make ideal presents.

Cured Polyester resin may also be engraved by the jeweller or watchmaker, just as is possible with metal objects. Advertising gifts acquire an especially personal touch when engraved with the name of the recipient. Branding with a glowing metal branding stamp or a soldering iron is also feasible.

Costs involved in production of advertising samples

As a guide a mould measuring 75 × 115 × 40 mm (approx. 3" × 4½ × 1⅝") would hold 400 grammes (approx. 14 oz) resin. By buying at the best quantity rate such a piece would cost at present prices about 15–18 p.



The base and part of the stem are made from 70 percent G. T. S. resin, 30 percent amber resin and 0.1 % 'crack effect' paste. M. E. K. hardener was used.

A beautiful rose embedded in resin. It was first carefully placed in very dry sand. This prevented the petals from drooping and helped to dehydrate the rose. The box of sand was then placed on a hot radiator for four weeks. The sand was then carefully poured off and the rose sealed with hair spray. Finally it was cast in three layers of G.T.S. resin.

Reliefs and copies of all kinds can be made with Silicone rubber and cast again in one go with GTS potting resin. You achieve an absolutely true-to-life reproduction, although about 2% shorter in length due to the shrinkage of the resin.

in the apprentices' workshop or even distributing such jobs to home-labour if the moulds can be satisfactorily delivered.

In which fields are castings a good advertisement?

Such castings would be very good for the following branches of industry:

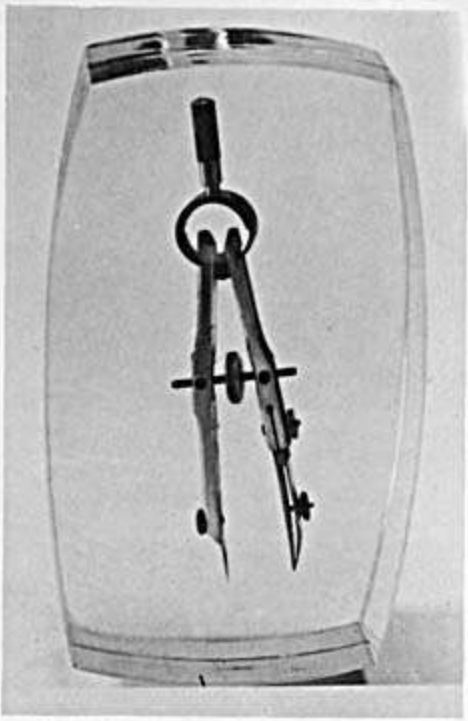
Ball-bearing factories.
Spark-plug factories.
Soldering factories.
All types of foundries.
Pencil or ball point factories.
Manufacturers of pencil/ball point refills.

One can quickly fill a series of moulds and after practice, finishing and polishing time on such a piece, should not take longer than 30 minutes. It will be seen therefore that for advertising and commercial purposes the castings need not be expensive. Resin castings of this size can command high prices in souvenir shops and if artistically arranged and well finished, can be very profitable.

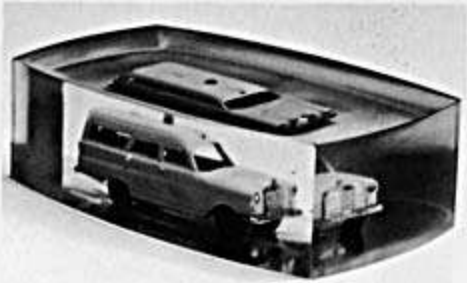
To this sum must be added a suitable sum for advertising, sales costs, wages and packing.

With quantity one can save a lot, especially with regard to labour-time. For many firms there is the possibility of making such advertising specimens

Aluminium tube manufacturers.
Cutting-tool and cutlery manufacturers.



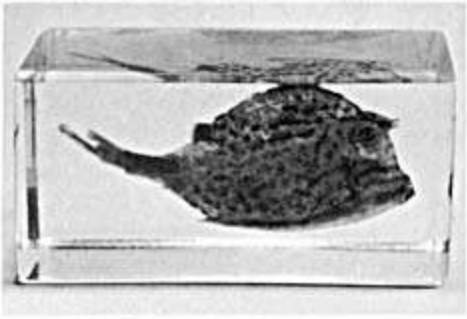
For every profession you now have the possibility of having your professional symbol on the front door.



Jewellery makers.
Manufacturers of electronic apparatus.
Metal fitting manufacturers.
Manufacturers of safety locks (with keys).
(an embedded key can be a symbol for many things).
Precision tool manufacturers.
Screw factories.
Battery factories.
Car factories.
Tyre factories.
Optical apparatus factories.
Shoe factories.

It is worth considering the making of such advertising specimens in your own firm.

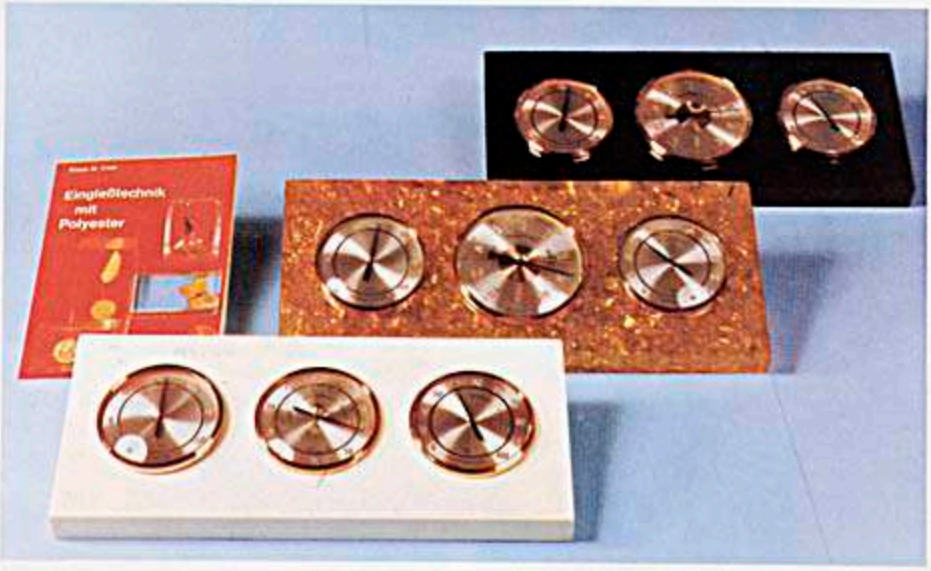
Sales promotion of ones products could very well be carried out within the company using this medium. A paperweight for example on an Executive's desk would keep the Companies products before him in a fascinating form.



Strengthening with chopped mat and rovings

Pure polyester resin is not particularly good as regards strength, because it

This picture shows three beautiful examples of trophies and club badges embedded in G. T. S. resin.



Three different examples of a 'weather' panel. One tinted white, another black and a third amber with 'crack' effects. A wooden mould, lined with Formica, was used. The three wooden inserts must be removed immediately after the resin has set otherwise shrinkage will make this very difficult.

A special technique has to be used when embedding flowers. As with the rose this gentian was placed in dry sand for four weeks. It was then given several coats of hair spray and cast in resin.

Dried silver thistles are particularly suitable for casting into large decorative blocks. They make attractive bookends.

has china-like qualities. When hit hard it can break.

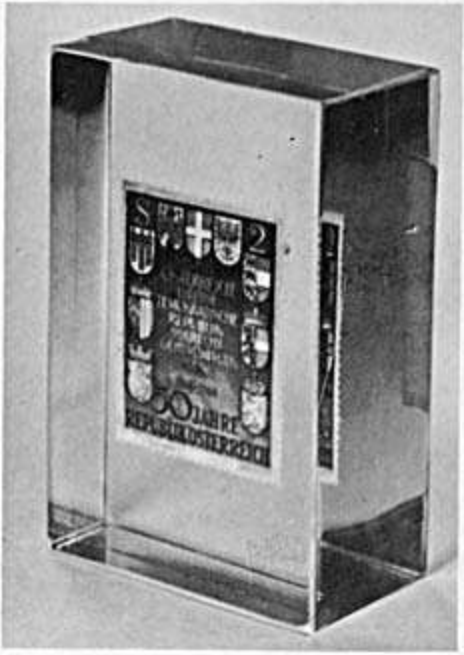
With glass and resin, however, a high strength factor is achieved.

The best related strengthening materials are very fine glass strands, about 1/100 mm. thick. These glass strands are in groups of 200 elementary strands. A normal roving again contains 60 single strands, thus 1200 strands to 1/100 mm. altogether. Such a strand has a resistance load of about 90 kg. In this way you can hold enormous weights with glass.

Iron or brass wire or wire mesh may also be used. This, however, does not give the desired strengthening qualities, because such metal wires are elastic and bendable and stretch at least 5–10 % before they break. Polyester resin however stretches only about 2–3 % in the casting resin method set out here, so that iron-wire holds the weights elastically, but the Polyester resin would be splintered by cracks.

Glass strands behave quite differently. They can hold large weights when expanded by 0.5–1 %, i. e., before the Polyester resin shows cracks.

Therefore these glass strands are very good for strengthening. The further advantage is that with transparent castings only a very little of the glass strand can be seen afterwards, so that an interesting decorative effect with simultaneous strengthening is achieved, since the light refraction index of glass and resin is closely linked.



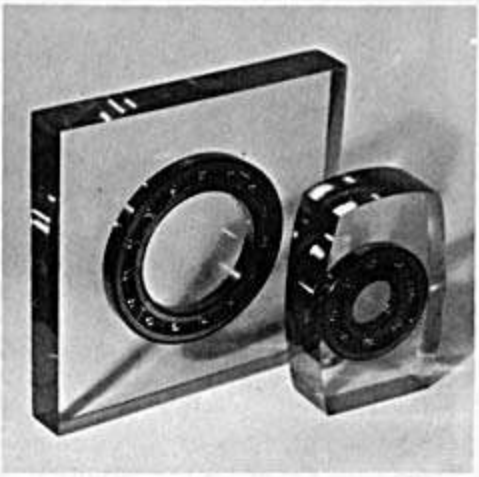
Stamps or club badges (also made of material) are suitable for embedding.

For further application in strengthening potting resins with glass mat and rovings, please see our brochure "Polyester and Glass Fibre". Parts 1 and 2.

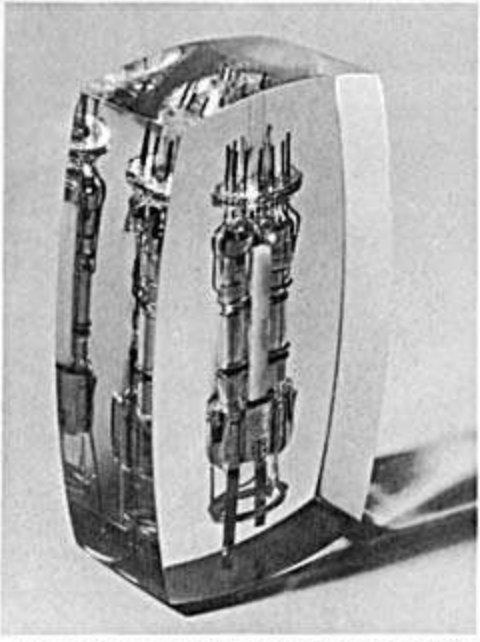
In the potting resin work-kit No. 3 as in the large kit No. 4 there is a piece of glass mat that can be used for the appropriate applications.

To start with we recommend making a lamp shade or a pen-tray out of Polyester and glass fibre. As a mould base fairly large glass bottles or saucepans are suitable for lamp-shades. Aluminium saucepans which

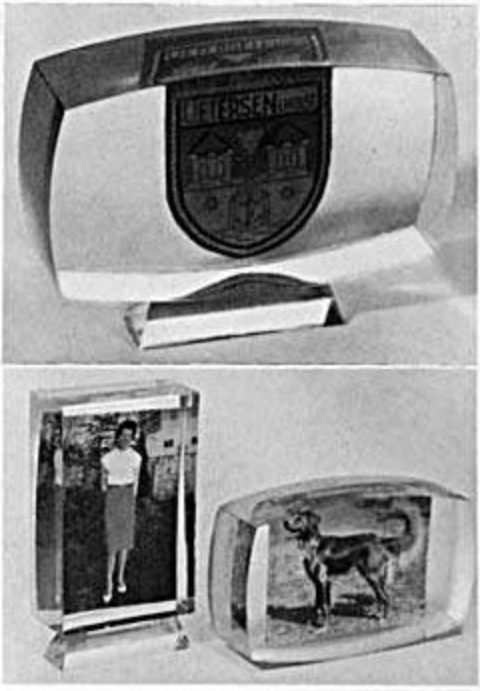
This Christmas rose is almost true to life, although it is made of an artificial material (Polythene). In its embedded state you cannot see the difference.



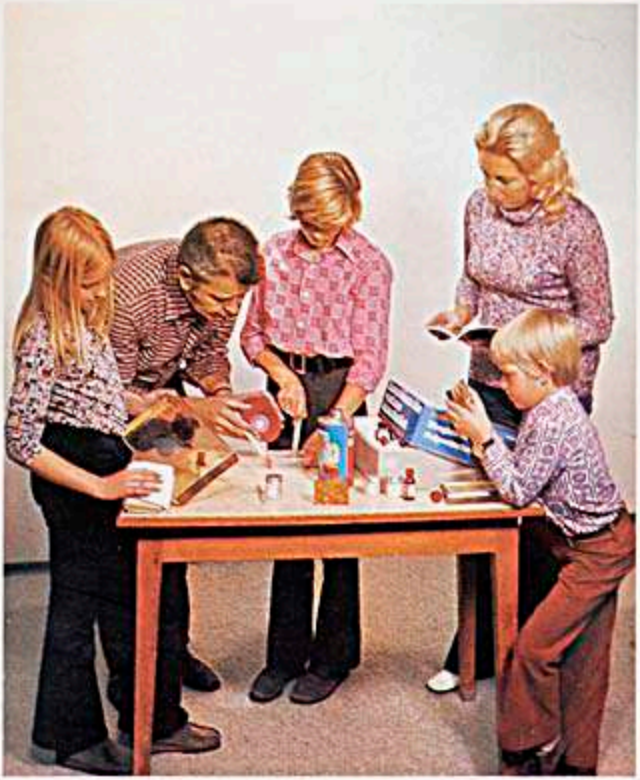
For technicians and technical dealers eg. in clients' visiting rooms — not only ball-bearings are suitable, for nearly every product increases in psychological value and attracts attention.



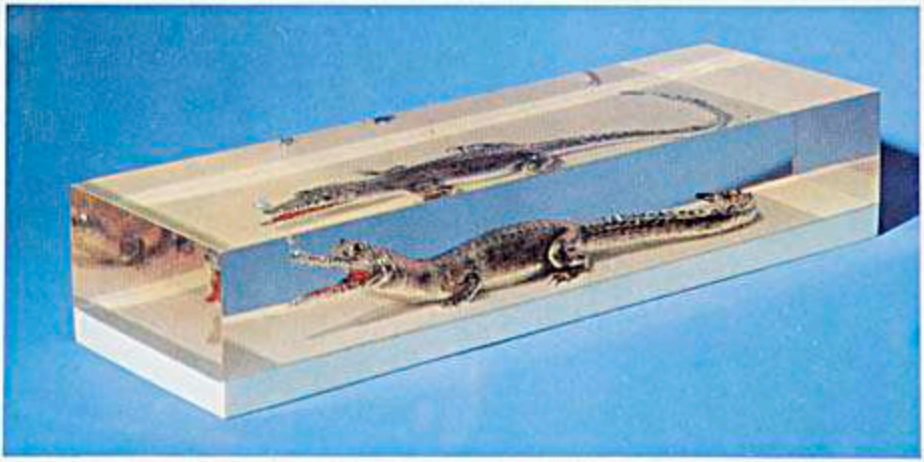
Here you have a triple television tube for colour television sets. Such a highly sensitive object when put on display catches the eye in the shop window of any radio and television dealers.



Colour photographs as well as black and white prints are good for embedding without any special treatment and are protected against fading in this way. A city emblem or club badge made of cloth or metal is also good for embedding in GTS resin.



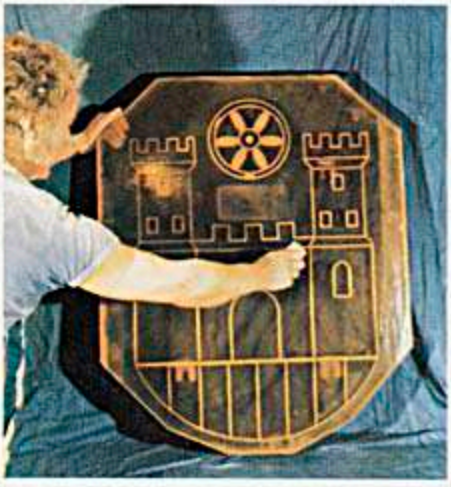
Cold setting plastics can be used by people of all ages. Youngsters can make their own presents and embed all sorts of objects for friends.



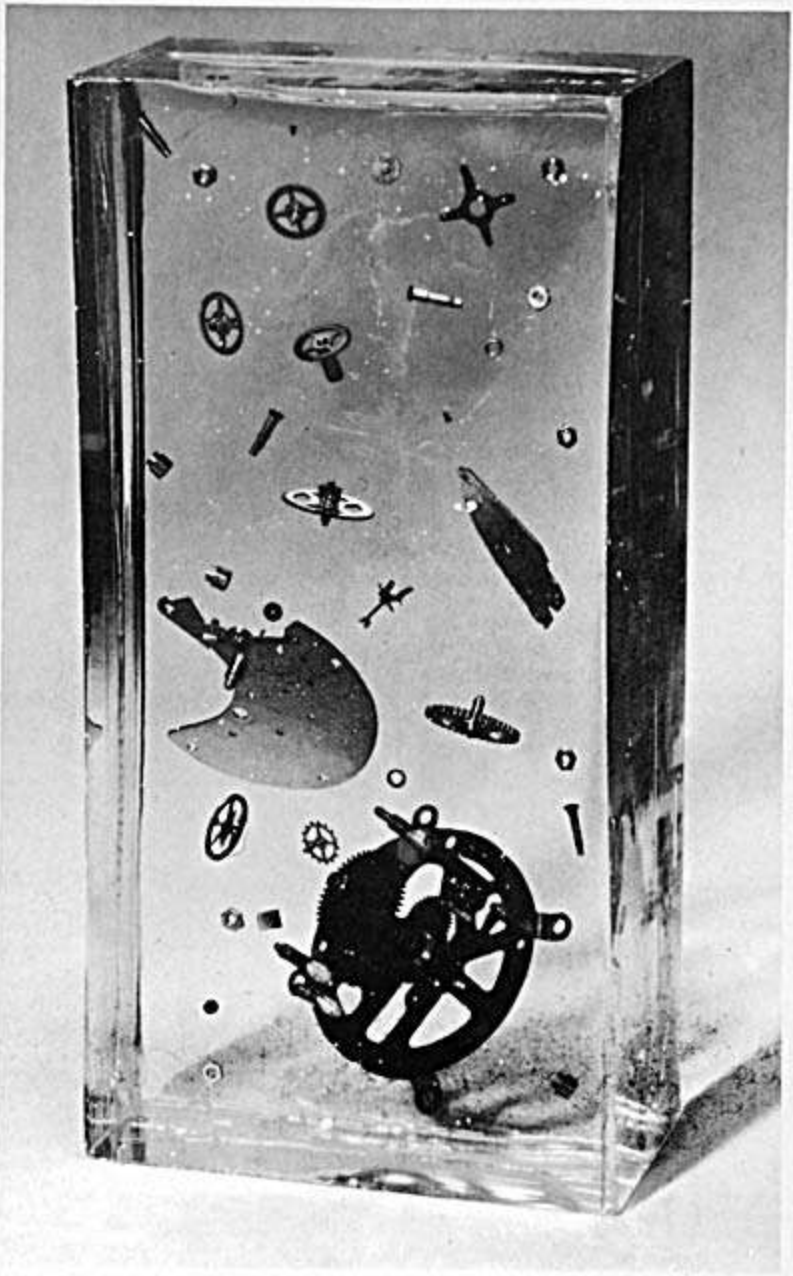
Something special. A small crocodile in clear plastic. While being attractive it is also educational. Embedding is an ideal method of displaying specimens in schools. It is 50 cm (1 ft 6 in) long. Apart from the white base it was cast in one piece and hence the small air bubble above the jaw.

Prizes and awards have greater acceptability.

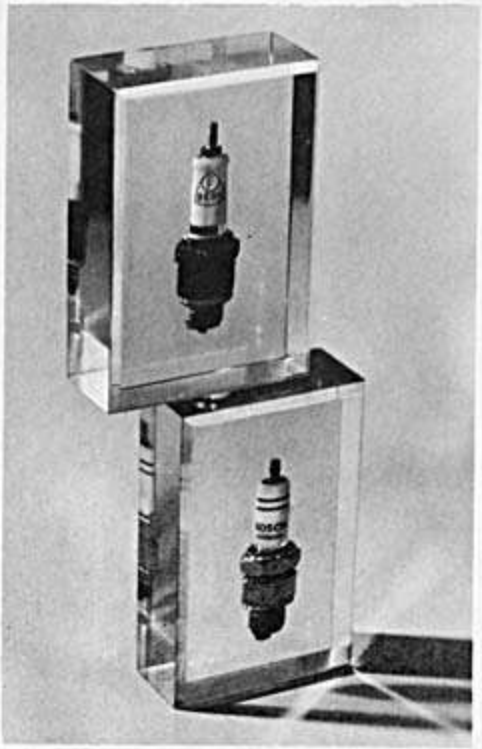
Old coins can be cleaned in a mildly chlorinated acid and then polished. They should then only be handled with tweezers.



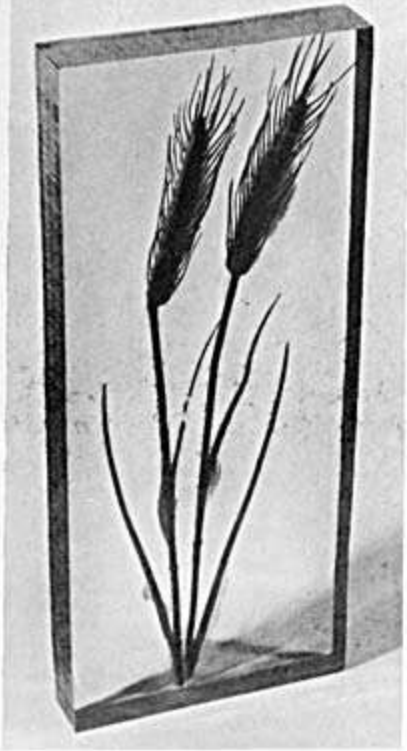
Brass rods were used to form the 'arms' of this city. The block was cast in one and the rods supported from below with brass studs. The block was then ground to size. It was sold for more than £100.

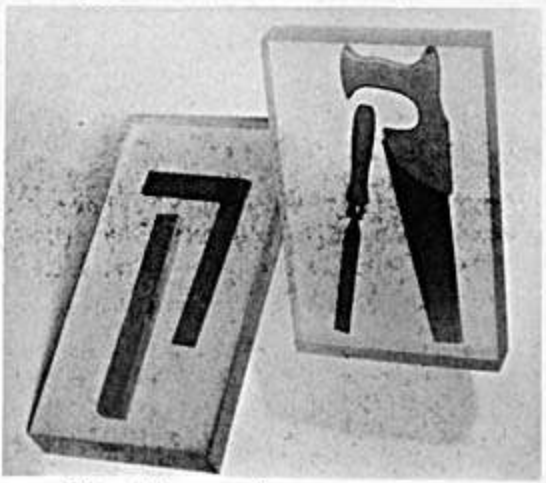


An alarm clock taken to pieces — as through scattered by an explosion — in potting resin.



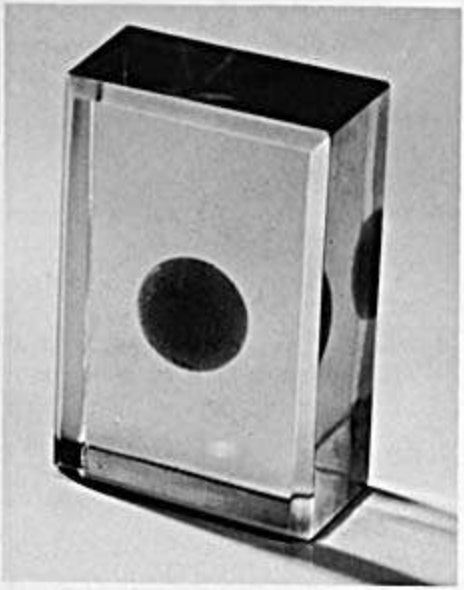
Such a spark plug looks very valuable when embedded. An arrow made of paper, if put in too, can point to a particular feature of such an object.





These tools are only meant to arouse interest. As a gift at work jubilees the professional tool symbolizes the respective profession.

A block like this with embedded plants has many uses: as a book end, paper weight, and glass brick. The mirror reflexes at the front are especially attractive.



A potted glass marble (possibly many coloured) always makes a suitable book-end.

These pliers make a good symbol for various professions.

are completely cylindrical inside and do not become narrower at the top, can be worked from the inside, so that the smooth side of the lampshade is on the outside.

When putting colourful decorations on to the rough side after curing, a mixture of potting resin with about 4 % Aerosil as a thickening agent is ideal. This makes a paste which can be painted on and coloured with PU colour pastes. A 1–2 % of colour paste gives vivid but still transparent colours.

Aerosil is a white, very light powder. It is somewhat difficult to stir this powder into the liquid resin, and must be stirred for a fairly long time. The amount put in can be increased according to the consistency desired (viscosity).

All mixing ratios given in this book are based on per cent by weight and not on parts by volume. However, as the specific weights of resin, hardener, colour pastes etc., differ only slightly from water (they mostly lie at 1.1–1.2) it is exact enough if the dose is according to parts by volume. The only exception is the very light Aerosil powder.

Practical short guide for embedding a Starfish

1. Make certain of the mould size, so that the starfish is surrounded by at least 1 cm of resin all round.

2. Wash or clean the mould with soap and water and then dry it. With tin moulds drying must take place quickly, so that no rust forms.

3. Make certain of the necessary amount of resin: either measure the cubic capacity with a tape measure or fill the mould with water and

   a) Pour the water into a second container, mark where it comes to, empty it and finally fill with resin.

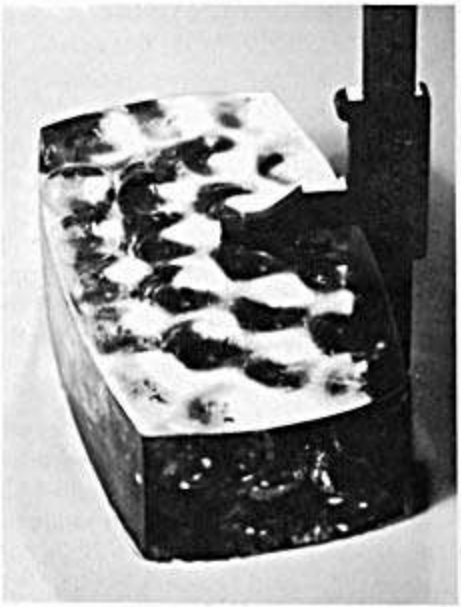
   b) Weigh the amount of water poured in, add 10 per cent by weight (specific weight of resin = 1.1).

   In both cases add 5–10 % to allow for loss.

4. Mix 30 % of the whole amount of resin with 1 % MEK hardener, pour into the mould and let it gell.

5. Fix the starfish with some resin on to the cured layer, so that it does not float up afterwards.

These are green marbles cast in G. T. S. resin. The surface of the mould was covered with melinex sheeting. These marbles were a product of a glass factory and made an ideal promotional item.



With this casting the resin only shrunk 2 percent. In this piece with glass marbles, the resin was allowed to sink between the marbles thus producing a relief effect. The resin has also shrunk away from the marbles leaving a silvery sheen around them. An extremely striking decoration or paperweight.

6. Wait till the sticky patch has cured.
7. Mix the rest of the resin with 1 % MEK hardener and pour it into the mould and carefully push a glass plate across or lay on a piece of melinex sheeting.
8. After 8–10 hours remove the cured specimen from the mould and remove any ridges with a file or sand paper.
9. In case irregularities have formed at the side due to too early removal from the mould, smooth this surface by grinding and polishing.

More experiments

Casting resins offer, due to their versatility, thousands of possibilites in the artistic field as well as in hobbies.

Normal polyester resins can be mixed with many mineral fillers and they then cure in exactly the same way. A large amount of gravel or quartz sand gives the advantage that the shrinkage of the polyester resin is considerably reduced.

'Exploded' clocks are favourite embedding items. This one was cast in a glass bowl. However, in order to remove the casting the bowl had to be broken.

To make a block from dry gravel and polyester resin, 10–20 % resin parts are enough. A block so filled can be made 5 times as large as a pure potting resin block in one go and without any risk and without cracks forming, because the heat is now absorbed by the gravel.

Pieces of coloured glass fragments may be broken with an iron pipe or a roller and mixed with polyester resin. When mixed with iron powder an especially heavy casting is obtained.

Copper powder considerably improves the thermal conductivity.

A mixture of polyester resin and wood or cork flour enables a block made out of it to have nails driven into it without any danger of cracks forming or splitting in two.

"Soft" fillers only slightly resist shrinkage during curing, so that such a casting will shrink more during curing. Remember, the greatest shrinkage takes place only after curing, so that from a useful initial adhesion to some bases additional shrinkage will occur when re-heating, and often the result is a splitting away from the base.

Fabrics of all kinds become hard and brittle from coating with Polyester resin and the curing which follows. Cured polyester resin can never be removed again from materials, because it is immune to solvents and chemicals.

If clothing becomes soiled, only immediate removal with solvents can help. For this, use Methylenchloride

6. Wait till the sticky patch has cured.
7. Mix the rest of the resin with 1 % MEK hardener and pour it into the mould and carefully push a glass plate across or lay on a piece of melinex sheeting.
8. After 8–10 hours remove the cured specimen from the mould and remove any ridges with a file or sand paper.
9. In case irregularities have formed at the side due to too early removal from the mould, smooth this surface by grinding and polishing.

More experiments

Casting resins offer, due to their versatility, thousands of possibilites in the artistic field as well as in hobbies.

Normal polyester resins can be mixed with many mineral fillers and they then cure in exactly the same way. A large amount of gravel or quartz sand gives the advantage that the shrinkage of the polyester resin is considerably reduced.

'Exploded' clocks are favourite embedding items. This one was cast in a glass bowl. However, in order to remove the casting the bowl had to be broken.

To make a block from dry gravel and polyester resin, 10–20 % resin parts are enough. A block so filled can be made 5 times as large as a pure potting resin block in one go and without any risk and without cracks forming, because the heat is now absorbed by the gravel.

Pieces of coloured glass fragments may be broken with an iron pipe or a roller and mixed with polyester resin. When mixed with iron powder an especially heavy casting is obtained.

Copper powder considerably improves the thermal conductivity.

A mixture of polyester resin and wood or cork flour enables a block made out of it to have nails driven into it without any danger of cracks forming or splitting in two.

"Soft" fillers only slightly resist shrinkage during curing, so that such a casting will shrink more during curing. Remember, the greatest shrinkage takes place only after curing, so that from a useful initial adhesion to some bases additional shrinkage will occur when re-heating, and often the result is a splitting away from the base.

Fabrics of all kinds become hard and brittle from coating with Polyester resin and the curing which follows. Cured polyester resin can never be removed again from materials, because it is immune to solvents and chemicals.

If clothing becomes soiled, only immediate removal with solvents can help. For this, use Methylenchloride

Appealing and attractive gifts can be made by embedding signs of the Zodiac.

(non-inflammable) or Acetone (inflammable).

In case these cleaning agents are not immediately available, nail varnish remover can be used in an emergency.

Nitro or artifical resin diluters are suitable for cleaning all apparatus and tools.

If a few drops of water are poured into polyester resin and mixed a milky liquid results, which nearly completely cures as well. If 10–20 % solvent, Acetone. Methylenchloride or Trichlorethene is poured into polyester resin and mixed the sediment stays transparent but does not achieve complete hardness, because the solvent does not penetrate the resin molecules.

Part of the solvent evaporates after a few days. With layer thicknesses under 5 mm the solvent will have completely evaporated after 2–3 days, so that the final hardness of the specimen is achieved later.

By adding these foreign materials, water as well as solvents, the gelation and curing time is considerably lengthened. When casting very thin layers up to 1 mm thick, a rapidly evaporating solvent, eg. Acetone or ether, will have disappeared by the time gelation starts and can then do no more damage. You can use this trick in order to lengthen casting time and, at the same time, to achieve a thinner casting material. With layer thicknesses over 1 mm do not try this, in order to ensure no unpleasant surprises. Casting resin can be made considerably thicker with a powder thickening agent such as Aerosil, even by just adding 2 % (parts by weight). This thickening, however produces a slight clouding. If a potting resin paste for painting is wanted use 3–4 % Aerosil (percent by weight).

The faint surface tackiness of all casting resins, caused by air inhibition can be avoided by adding paraffin wax. A 1 % of a 5 % paraffin wax solution in styrene is quite sufficient.

Paraffin wax with a melting point of 55° C gives the best results. The wax solution will be expelled to the surface of the resin during curing, due to its incompatability with resin, and forms a thin film.

From the foregoing it will be seen that by combining and mixing dyes pastes, fillers etc., there is much scope for experimentation into different effects.

Make your own mould with Polyester resin and glass mat

If large numbers of specimens are needed from a specific mould, it is often necessary to make a copy from

a positive core, in order to have a permanent mould.

Based on a model the size of a cigar box, made of wood, the following working stages must follow one another:

The wooden box is firmly glued or screwed to a flat base, best would be glass plate. Slightly round off the corners, otherwise the layers will be blocked with glass mat. The wood pores must be completely closed, seal them with polyurethane 2–3 coats, according to the quality of the wood.

Between each varnishing we recommend rubbing with sandpaper, grain size 240, so that any dust particles are removed. Then apply release wax to the mould with a cloth, a brush or a sponge. In order to ensure that this block comes out of the mould without difficulty polish the release wax with a soft woolen cloth and finally apply release varnish with a brush.

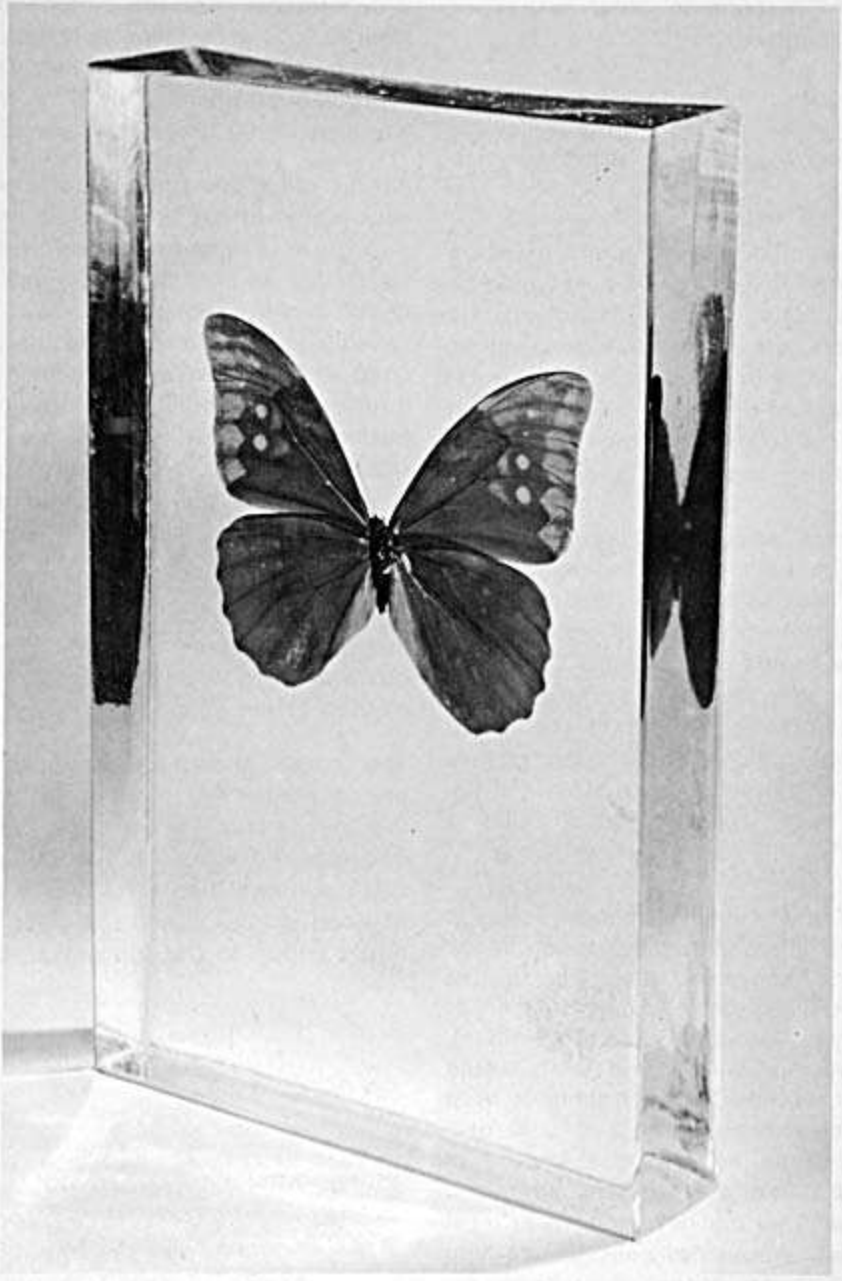
Release wax needs 3 minutes in which to dry, whereas release varnish needs about 30 minutes. After the release varnish has dried apply a layer of catalysed polyester resin to the mould. Because this very thin resin would run down the vertical sides it must first be thickened with 2–3 % Aerosil, so that an even layer thickness of 0.2–0.5 mm may be applied everywhere. This thin layer of resin must gell as quickly as possible, so that not too much Styrene evaporates.

We recommend therefore, adding 0.1 % cobalt accelerator after mixing with hardener. For the surface of a cigar box with a layer thickness of 0.3 mm about 100 g GTS casting resin plus 3 gr Aerosil. With 3 % MEK hardener = 60 drops is required.

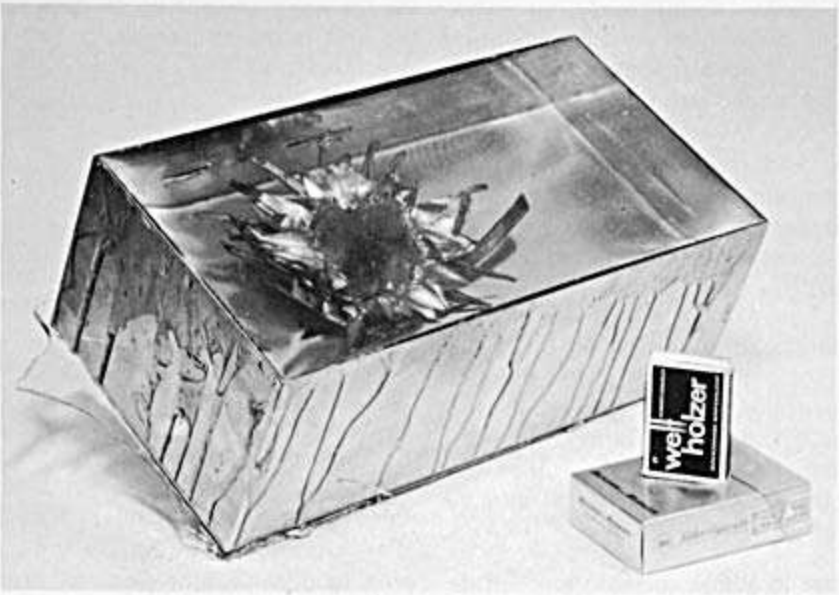
For an additional amount of cobalt accelerator of 0.1 % allow 20 drops = 1 gr. At a room temperature below 18° C this amount of cobalt can be doubled. After application, this so-called fine layer (also called the gel-coat) must harden at room temperature for at least 6 hours, before continueing to work with glass mat and resin. To shorten this curing process to about 1 hour, put the mould into an airing cupboard and cure it quickly for about 1 hour at about 50°.

Now lay the pre-cut pieces of glass mat on to the mould. Cut the pieces out with scissors and allow 1–2 cm overlap at the vulnerable points.

The edges give thicknesses at the places where they overlap, so that it is better to tear them at these points. The required size is drawn out with a felt pen and then a ruler or a strip of wood is laid on and the glass mat torn off. Due to the fringing a softer



Such a casting resin block suits any room as a book-end or standing decoration. In an art shop such a block when ground and polished costs at least £5 (according to size and quality).



A large potting resin block with an embedded flower shortly before removal from the mould. After grinding and polishing you get an attractive decorative piece. (See the picture on the back of the book.)

transition results which cannot be seen afterwards. When the glass mat is in position mix about 0.5 kg GTS resin with 3 % MEK hardener = 15 g = 300 drops. Since at this layer thickness the danger of cracks forming or heat rising is not great, we recommend, adding 0.1 % cobalt accelerator, so that the resin gells in about 20 minutes.

Take note:
Cobalt accelerator must never be mixed directly with MEK hardener, because otherwise the danger of a sudden decay or explosion of both these chemicals exists. Therefore one or the other must always be stirred evenly into polyester resin before the second active material is added.

The catalysed resin must now be worked within 20 minutes. The resin is dabbed on to the glass mat with a brush. Apply carefully, but be certain that the glass strands do not get out of place.

In this way you soak all the glass mat evenly. All light patches which can still be seen consist of air bubbles. These must be removed by dabbing again and again carefully, so that the sides are free of bubbles. A layer thickness of about 1 mm is achieved in this way with glass mat. If the side

needs to be stiffer apply an extra strip of glass mat on to the upper edge, or 2 or 3 layers of glass mat may be added to the sides in the same way. Afterwards – i. e. after curing and removal from the mould – extra reinforcements can be added in the same way. The next layer always adheres to the side exposed to the air.

Be careful that the layer thickness does not get too thick at the corners because slight shrinkages result due to resin rich areas during the subsequent curing, and the otherwise smooth surfaces are later slightly curved.

In order to stiffen surfaces still further additional reinforcing frames made of strips of wood or steel bars may be fixed with glass/resin. The technical term for this is overlaminating.

After the resin has gelled cut the edge with a knife. If you wait till curing is complete, you will require the use of a saw or a cutting disc. After about 5–6 hours, or when curing quickly in an airing cupboard after 1–2 hours, removal from the mould may begin.

With a cigar box it will not be possible to pull the box out, because slight shrinkages have occured during curing, the box has to be taken apart from the inside.

Ready-packed casting resin kits

All materials are available seperately as well as in kit form.

Please send for our up to date price list and terms of trading.

Achieving cracks with crack-effect paste

Recently we have developed a crack-effect paste which makes it possible to produce disc-like small cracks inside a casting resin block, which give an especially attractive crystal-like effect due to the light refraction. Because these cracks stay inside the block, (with large blocks some force their way to the outside) it cannot disintergrate, as would be the case with lengthwise and diagonal cracks.

The method of working is quite simple: According to the size of the resin block and the desired thickness of the cracks 0.5–2 % of crack-effect paste is stirred into the Polyester resin **before adding the hardener.**

The adding of the crack-effect paste nearly always produces a faint cloudiness in the resin. This cloudiness disappears, however, by itself in the course of 1–2 hours and must be left until clear before adding the hardener. By heating the resin to about 30–40° C. this period of waiting is reduced. Then the hardener is added as usual and poured into a mould. After gelation the rise in temperature begins owing to the chemical reaction (polymerisation). This causes an even cracking in the resin in combination with the crack-effect paste.

Small amounts do not become very warm during curing. These parts will

A collection of mussels, corals, starfish and suitable water plants provides a "carefree" aquarium.

crack far more if the whole mould is heated to about 90–120° C shortly after gelation.

Larger resin blocks heat themselves due to the localization of heat, so that re-heating or additional heating is not necessary. The optical effect of these small cracks is better with amber – like colours rather than with the clear GTS resin.

The way crack-effect paste works depends on a gas separation, which is greater at higher temperatures than at lower ones.

The crack-effect paste should be stored in a cool place. Avoid contact with the skin.

What have I done wrong if something does not work?

1. *The Polyester resin apparantly will not harden, because it adheres to the surface.*

   Answer:
   Polyester resin is always tacky on the side which the air gets to. Because of this one gets the impression, falsely, that it does not become hard. This surface tackiness can only be got rid of by covering the surface eg. with melinex sheeting or with a piece of silver paper (aluminium foil) while still liquid, before gelation. Technically this tackiness is a result of the direct contact of the resin with the oxygen in the air. (Cessation of the chain-building process during polymerisation.)

2. *Air bubbles are to be found after curing. Above the embedded object. How can I prevent this?*

   Answer:
   These air bubbles must have been in the embedded object previously. Shortly before gelation – and also during gelation – a rise in temperature of the resin results. Enclosed air in the specimen expands and as a result of this rises to the surface as a bubble. Due to the ever-increasing heat new bubbles continue to rise to the surface. When, the resin is beginning to gell and is no longer thin, a few bubbles stay put, halfway. The air must therefore first be removed from the potting specimen or casting must take place in a vacuum.

3. *Removal from the mould does not work, the specimen will not come out of a glass mould, what can you do?*

   Answer:
   Some glass dishes have been sent to us by post from customers, saying that the glass dishes are not of any use and probably the potting block too. In most cases the pieces arrived here out of the mould. Therefore the best thing to do in this situation is to wait. The polyester resin shrinks even more over a period of 2 days and thus nearly always loosens itself from the mould. This procedure can be speeded up by heating several times to about 100° C and then cooling again to – 10° C. (possibly in the refrigerator – remove any food). Due to the various expansion co-efficients of these different ma-

terials the stress in the area of contact becomes so great that loosening nearly always occurs by itself.

4. *When grinding, the casting resin block remains dull. How can I get a highly polished surface?*

Answer:
Please re-read the article "Grinding"... on Page 28. You should not begin grinding until the block is hard enough, since a hard block can be ground more easily.

5. *When casting into silicone rubber moulds the surface of the silicone rubber is affected and the block in this area does not become clear.*

Answer:
Before casting the resin into the silicone rubber mould, heat it to 50–80° C if possible (according to size), so that gelation occurs as quickly as possible, at least at the edges, and thus the action of the Styrene on the mould surface is as short as possible.

It often helps to wait for a while after adding the hardener before casting the resin into the silicone rubber mould and to only begin casting when the colour changes from green to yellow. Gelation will commence shortly after this transition.

This round aluminium plate was cast by a special process and had a matt finish. A frame was placed around the plate about 1 cm (under ½ in) deep and resin poured into it. It was then polished.

We stock sea horses in different sizes. The very small ones are only about 15 mm long, whereas the large ones can measure up to 70 mm in length. These animals are often somewhat bent on delivery. Soften them in water, lay them out straight, bend the tail into the desired curve and dry them again.

A paper weight, here with everlasting yellow flowers, decorates every desk.

This beautiful trophy is a proud possession of the club.

Diamond grinding is a fine art. With our G. T. S. resin similar effects can be obtained but on a much larger scale.

Even the smallest parts of the clock are magnified in this block of resin. The octagonal shape was achieved by grinding.

Souvenirs are a profitable business and can easily be made using G. T. S. resin. Any special events can also be remembered. Silk Screen was used for the lettering on this example.

1. The quantity of resin required to fill the mould is marked on the underneath. To convert into grams add 15 percent as resin has a higher density than water.

2. Remember — 20 drops of hardener are equivalent to one gram. The bottle has a dispenser that makes it easier to measure the correct quantity.

3. Mix the resin and hardener with a wooden spatular slowly to avoid bubbles.

4. Cast the first layer.

5. Place the object on the top when the first layer has gelled (almost hard).

6. Cast the last layer.

7. Place a sheet of Melinex sheeting across the top of the mould and a clear, smooth, tack free surface results.

8. Remove any surplus resin with a sharp knife or glass paper.
By following these instructions carefully your castings should be perfect from the start.

Casting and curing times of GTS resin

Test quantity 100 g. at 20° C.

Quantity of hardener	Potting time	Curing time
0.5 % MEK hardener	45 mins	10 hours
0.8 % MEK hardener	40 mins	3 hours
1 % MEK hardener	35 mins	2½ hours
1.5 % MEK hardener	25 mins	2 hours
2 % MEK hardener	20 mins	1½ hours
2.5 % MEK hardener	15 mins	¾ hour
	Yellowish colour from here	
3 % MEK hardener	14 mins	¾ hour
4 % MEK hardener	12 mins	½ hour
5 % MEK hardener	5 mins	½ hour

Moulds	Contents.	Quantity of resin	Recommended hardener
large moulds			
rectangular mould	140 cm³	160 g	40 drops
round mould	85 cm³	95 g	20 drops
oval mould	500 cm³	530 g	100 drops
small moulds			
round mould	9 cm³	10 g	4 drops
rectangular mould	9 cm³	10 g	4 drops
triangular mould	8 cm³	9 g	4 drops
six sided mould	10 cm³	11 g	4 drops

20 drops MEK hardener = 1 g

The amount of hardener added depends on the amount to be cast.
We recommend keeping to the following amounts:

10– 50 g GTS resin = 1.5–2 % MEK hardener
50– 200 g GTS resin = 1–1,5 % MEK hardener
200–1000 g GTS resin = 1 % MEK hardener
1– 10 kg GTS resin = 0.8% MEK hardener

With more than 10 kg use accordingly less MEK hardener, but no less than 0.6 % MEK hardener.

Properties of GTS casting resin

Parts of polimerisable substance	100 %
Styrol contents	35 %
Acid No. DIN 53402	<25
Viscosity at 20° C DIN 53015	1000 C P
Specific weight at 20° C. DIN 51757	1.12
Refraction index at 20° C. DIN 53491	1.55
Styrol compatibility	1 : 8

Properties of cured resin

(Heated for 2 hours at 100° C.)

Relative dielectricity constants 10^6 Hz DIN 53483	3.00
Dielectric loss factor. 10^6 Hz DIN 53483	0.02
Surface resistivity DIN 53482	10^{13} Ω
Specific resistance DIN 53482	10^{15} Ω cm
Leakage resistance DIN 53480/VDE 0303 Part 1	KA 3c
Tensile strength DIN 53455	600 kp/cm²
Bend strength DIN 53452	800 kp/cm²
E – modulus in bend DIN 53457	37000 kp/cm²
Bend at break DIN 53452	0.5 cm
Shock resistance DIN 53453	9.0 kpcm/cm²
Pressure resistance (L–P 406b Meth 1021)	1650 kp/cm²
Point impact resistance DIN 53456	1800 kp/cm²
Heat resistance according to Martens	55° C

Attention!

Liquid MEK hardener is caustic. Therefore be careful when using this peroxide – especially with children.
Never wipe up MEK hardener with your handkerchief. No harmful effect can be felt on the skin if there is no over-sensitivity.