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# The Story of Stained Glass

Prepared and Sponsored by the  
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# The Story of Stained Glass

**T**HE reproduction opposite is an impression of Notre Dame de la Belle Verrière — Our Lady of the Beautiful Window — in the ambulatory of Chartres Cathedral. It is very precious to the people of France and its value is incalculable.

The central portion is said to have been saved from the fire of 1194 by devout citizens of Chartres who risked their lives to rescue it from the flames.

It is well known to lovers of stained glass, whether they have admired it in its magnificent setting or in photographic reproductions.

Exquisite as this window is, transplanted to an American cathedral it would be out of harmony, not only with other branches of decorative art within the building, but particularly with the atmosphere and conditions of our national life and times.

A good window is good anywhere, but it is best in its right environment, and good windows suited to our own environment are being made in our own country by our own craftsmen.

## *The Purpose of Stained Glass*

**R**EDUCED to its simplest terms, the purpose of a window is to admit light and at the same time to protect the interior of the structure and its occupants from the elements.

It may be decorated in any manner harmonious with the surrounding architecture which does not interfere with this premise. The glass may be colored and the light controlled,

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but the problem is always to be stated in terms of direct active light.

No other craft deals in light as brilliant or elemental; and so if colored glass is used, color is of the first consideration. Pure color in light has the power of lifting the observer out of himself. A window should be inspiring, not simply exciting. Color takes this way of suggesting virtues and ideals, much as do pure sounds in music.

The broken, harmonious color of a stained glass window creates its own aesthetic atmosphere, and definitely quickens the emotions in the warmth and beauty it spreads throughout an interior.

### *Its Substance and Nature*

A STAINED GLASS window is made of pieces of glass, usually held together by lead. Webster solemnly informs us that glass is an amorphous substance consisting ordinarily of a mixture of silicates.

It is made by fusing together some form of silica as sand, and alkali as potash or soda, and some other base, as lime or lead oxide.

Lead is a metallic element, heavy, pliable and easily fusible.

All colored glass is, strictly speaking, "stained" by some metallic oxide added to it in the process of manufacture. We have the term "stained and leaded glass" in recognition of the material that most commonly joins and supports the pieces of glass. Or, in its simplest form, a window may be composed of bits of clear or patterned glass without color, when it is called simply, "leaded glass."

These are the cold matter-of-fact definitions. But they do not reveal the soul of stained glass — the glory of designed color and light in action.

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Webster gives us a key to the wonderful possibilities of glass in his use of the term *amorphous*. In the hands of master craftsmen this apparently hard and brittle material is capable of taking on elusive qualities of brilliance and movement. Stained glass comes alive in light. The active radiation and vibrant color quality is the most poignant attraction of all great windows.

Stained glass possesses an aura of mystery and romance. The very nature of the materials and processes of glass-making are conducive of mystery. Opaque substances are transformed into a completely different material; one isn't quite sure how. The dull sand, lime and soda that went into the furnace comes out glowing and vibrant, to be controlled only by the greatest skill. It is still sparkling and elusive when it has been cajoled into its final shape.

In a modern world of plastics, it is discovered that glass is the ancient and original plastic. It is not a crystal, but in its formation, is as near like water as anything else. Stained glass windows have been appropriately called cataracts of color between cliffs of masonry.

### *Its Early Beginnings*

THE substance called glass was known and used some five thousand years ago by the then existing civilizations of Asia, eastern Europe and Egypt, but it was not until about the third or fourth centuries after Christ that glass began to be used in windows in the Christian basilicas of Italy and elsewhere in southern Europe. Therefore it becomes apparent that stained glass is the only art in the service of Christian worship wholly developed during the Christian era.

As the early windows were not large the glazing doubtless was similar to that of Arabian windows: small pieces of

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translucent glass set in plaster to form a design and to give the effect, when placed against light, of sparkling jewels. In later windows larger pieces of glass were used and were leaded together in simple floral or geometrical design, resembling the mosaic wall decorations of the period.

But it was not until Christian architecture became creative in western Europe, in an *environment* distant from the heaviness of Romanesque and the intense sunlight of the south, that stained glass became alive. Architects, artists and craftsmen were imbued with the ardor of the religious revival. Many of them had participated in the Crusades and had marvelled at the wonders of the East. The pointed windows observed in the slender, graceful Saracenic mosques appealed to them as perfect models to employ in their own new and original form of ecclesiastical architecture; the Gothic Cathedral.

Because of the climate and latitude of northern Europe, the window became the chief element of its architecture. Here, the early mosaic-like use of pieces of colored glass in church windows blossomed into the great rose window and soaring lancets of Chartres and other cathedrals of the twelfth and thirteenth centuries, to be adapted almost immediately to the more northerly climate of England.

### *Its Progress Through the Centuries*

THE twelfth and thirteenth centuries in Europe have been designated the "Golden Age of Stained Glass." The first thought of the designer was that of glazing. He planned in terms of leadwork and irregular small pieces of richly colored glass, augmented by such painting as was absolutely necessary to provide outline and form that the leads could not give to his two-dimensional drawing.

As the great Gothic age was succeeded by the Renais-



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sance after the late Gothic and Transitional periods, the ideals of rich color and simple treatment were abandoned; and, when the tendency toward more light introduced the use of "canopy" in the design, more and more white glass was employed. Windows began to lose their charm and integrity as painters asserted their personality. Glazing became secondary to painting and glass was cut to larger and more regular patterns, and painted with pigment in full color on white glass and in perspective. Leads were no longer an integral part of the design and became an obstacle to the painter whose desire was to exploit himself and his talent at the expense of design and color. His was not a stained glass window but a representation on glass of an oil painting.

In the seventeenth century, European glass continued to decline until in the eighteenth, even so eminent a painter as Sir Joshua Reynolds failed miserably in his attempt to rival or excel the work of the early craftsmen.

In the second half of the nineteenth century in Europe there were faint stirrings of renewed interest in the arts of the Middle Ages, while in the United States, our own artists ventured down new avenues of glassmaking and design to compete with imported windows. They failed, however, to catch the true spirit of stained glass and their products were quite unsuited to their purpose.

It was not until the turn of the century that there were signs of a true revival. American architects and glassmen journeyed to the shrines of early glass to study buildings and windows. Overwhelmed with astonishment and admiration at the beauty and appropriateness of the windows which for seven hundred years had withstood the onslaught of time and tempest without loss but rather with an increase in splendor and richness, they returned to their American workshops filled with the desire to carry on the glory of

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these jewelled windows, adapted to our own times and our own needs.

Knowledge of their craft increased. Today our artists understand the potentialities and the limitations of their medium. The very nature of their designs and the execution thereof is restoring to old and new, great and small churches of America, the purity, brilliance and color of the glass itself as the mediaeval men first knew it.

### *What is a Stained Glass Window?*

A STAINED GLASS window, installed in its proper place in a building, is perhaps best described as a decorative composition, constructed of hundreds, even thousands of pieces of irregularly cut white and colored glass, bound together by strips of grooved leads, soldered at the joints, to form a planned design, the entire window secured in the opening at regular intervals by metal saddle bars tied with wire and soldered to the leads, the whole reinforced at greater intervals by tee-bars fitted into the masonry.

With the exception of a stain painted and fired to produce a yellow tone in white glass, the only pigment used is a reddish brown or black powdered oxide to delineate features and form, drapery and pattern. The pigment is rendered permanent by fusing in the surface of the glass at a high temperature.

The color in glass is in the substance itself. While the mass of colorless glass is still in its molten state, various chemicals are added to it in the pot. Copper oxide, under different conditions produces ruby, blue and green, while cobalt is the principal base of fine pure blues. Green is also obtained from chromium and iron oxide. Golden glass is sometimes colored with uranium, cadmium sulfide, or titanium, and there are fine selenium yellows as well as

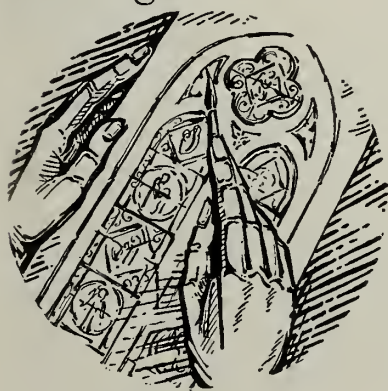
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vermilions. Ruby is also colored with the noble metal, gold. This method of staining or dyeing glass is the same as that used in the Middle Ages. For this reason it is called antique glass or pot-metal, from the pot in which it is made. A lump of the bubbling mass is caught up at one end of a blow pipe, blown into a cylinder, cut, flattened and cooled. Its very imperfections are often a part of its glory.

Flashed glass is made by dipping a ball of molten white glass into molten colored glass which, when blown and flattened, results in a less intense color because it will be white on one side and colored on the other. The use of flashed glass enables the craftsman to obtain certain effects not otherwise possible.

### *How a Stained Glass Window is Made*

STAINED GLASS is a hand craft, and is practiced in America today in virtually the same manner as it was in the Middle Ages. Modern technique is comparable to that of the twelfth and thirteenth centuries in Europe, although some of the tools — notably the glass cutter and the soldering iron — have been improved for rapid and more skillful handling.



DESIGNING

The steps in the production of stained glass windows are briefly as follows:

The making of the DESIGN comes first. It is usually a small-scale study of the window, intended to convey an impression of the color and light of the full-sized window.

After the design has been approved by the donor, committee, clergy, or others interested, the craftsman takes measurements or templates of

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CARTOONING

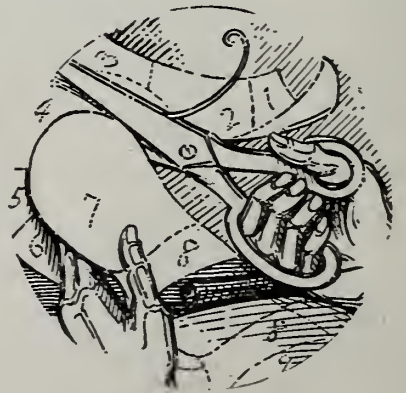
the actual window openings. The template is a pattern, usually on paper or cardboard, of the actual size of the spaces to be filled with glass.

A full-sized drawing called the **CARTOON** is next prepared, — generally in black and white. The suggestions of the first sketch are de-

veloped further in the cartoon.

From the cartoon, the **CUTLINE** and **PATTERN** drawings are made. The modern cutline drawing is a careful, exact tracing of the leadlines of the cartoon on heavy paper. The leadlines are the outlines of the shapes for patterns to which the glass is to be cut. This drawing serves as guide or reference for the subsequent placing and binding with lead of the many pieces of glass.

The pattern-drawing, usually on heavy paper, is a carbon copy of the cutline drawing. It is cut along the black or lead lines with double-bladed scissors or knife which, as it passes through the middle of the black lines, simultaneously cuts away a narrow strip of paper, thus allowing sufficient space between segments of glass for the core of the grooved lead. This core is the supporting wall between the upper and lower flanges of the lead, which is something like a miniature girder or like the letter H lying on its side.



*The mediaeval craftsman had no preliminary sketch, unless it were an illumination on parchment; nor had he paper patterns. His first step was to smooth a wooden slab twice the size of a window panel. On this he scraped chalk,*

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*sprinkled it with water, and spread the paste around until the entire board was covered. He measured off the size of*



*the panel on half the board, and carefully drew such figures as he desired, going over the lines with red or black, perhaps with the self-same colors used by the monks in the scriptorium for illuminating manuscripts.*

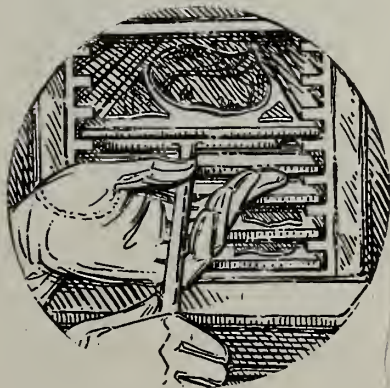
*The drawing served not only as cartoon, but also as cutline and pattern, and later for tracing significant form.*

The glass is then selected from the large stock always kept hand. The GLASS CUTTER places the pattern on a piece of the desired color, and with a diamond or steel wheel cuts the glass to the shape of the pattern.

*In the Middle Ages the glass was cut with a tool which was nothing more than a sharply pointed rod of iron, heated to a high temperature. The red hot point was drawn along the moistened surface of the glass placed over the chalked cartoon, and the glass snapped apart. The fracture was not very accurate and the rough*



PAINTING



FIRING

*piece had to be chipped or grozed down to the exact shape with the help of hooked tools called grozing irons.*

After the glass has all been cut, the PAINTER takes over. He paints on each piece of glass, with special vitrifiable paint, the main outlines of the cartoon. Further patterning

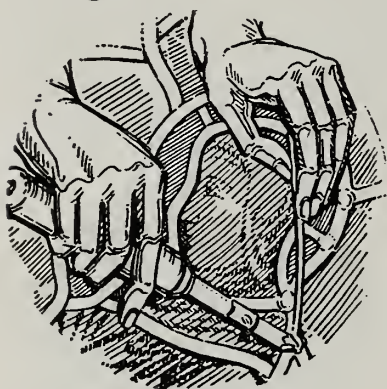
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is applied in halftone mats to control the light and bring all the colors into closer harmony.

Much of this painting is done while the glass is up in the light, held in place on a plate glass easel by means of beeswax. In this way the painter approximates the conditions in which the window will eventually be seen. These painted pieces are FIRED in the kiln at least once and perhaps several times to fuse the paint and glass.



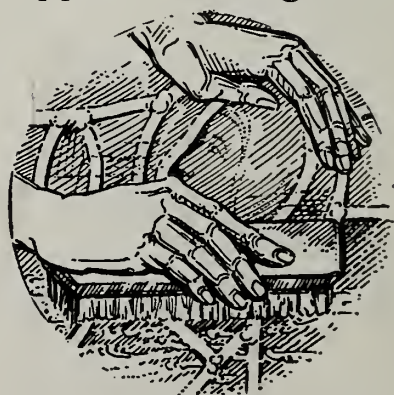
GLAZING



SOLDERING

The glass is now ready for the GLAZIER. The cutline drawing is spread on the glazier's bench and laths are nailed down along two edges of the drawing to form a right angle. Long strips of wide lead are placed along the inside of the laths. The piece of glass belonging in the angle is fitted into the grooved lead.

A strip of narrow lead is fitted around the exposed edge or edges and the next required segment slipped into the groove on the other side of the narrow lead. This is continued until each piece has been inserted into the leads in its proper place according to the outline drawing beneath. The many joints formed by the leading are SOLDERED; and the entire window is CEMENTED on both sides to make it firm and water-tight. The window is made in sections of a size convenient for one man to handle.



CEMENTING

After the completed window has been thoroughly in-

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spected in the light, the sections are packed and shipped to their destination where they are installed and secured with reinforcing bars.

### *Planning for Windows*

**T**HE inexperienced may find themselves at a loss to know just how to go about the procurement of stained glass.

If the structure in which a window or group of windows is to be placed is a new one, the services of the architect may be enlisted. Even if the building is not new, the architect may still be available and he will be interested in the enrichment of his creation. His advice should be valued, and he may refer his client to other authorities familiar with stained glass.

There are a number of good books on the subject which can be found in most public libraries. (A brief bibliography is included in this brochure.)

One may go to see windows in the neighborhood that are recommended by capable authorities. Then write or call on one of the designers whose work is liked, giving him as much information as possible. The style of architecture of the structure is of first importance. The designer wants to know the size and shape of the windows, — that is, the measurements of the actual glass or daylight openings, and whether the tops are rectangular, round, Gothic arched or indented with cusps or points. He will be interested in the direction of the light they receive, — north, south, east or west, — and whether neighboring trees or buildings obstruct the light stream. The height of the windows from the floor, their position in the building, and their relation to any windows that may be nearby, are also matters that will concern him.

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Copies of the architect's plans will answer many of these questions and photographs will take care of others, but even rough diagrams and measurements with descriptive notes will help.

If ideas have been formed about the kind of windows wanted or the themes to be symbolized, share them with the glass craftsman, and if he can be given an idea of the sum that can be devoted to the window, he will be better able to illustrate what he can do within the budget.

It is unjust to ask several glassmen at random to prepare special color designs and then choose one just because it is cheap and is thought to be pretty.

The craft of stained glass is a serious and learned art, and the craftsmen are skilled technicians and designers worthy of the same respect and consideration to be given one's physician or lawyer. With them only a life or reputation may be risked, but through the craftsman in glass one is helping to crystallize and symbolize the faith and hopes and dreams of our sons and daughters perhaps for generations to come.

If after a thorough acquaintance with designers of windows it is still impossible to make a selection, and special color designs are required in competition, offer to reimburse each for his time and effort in studying the problem. This is in accordance with the best practices of the architectural profession, and the designer deserves the same consideration.

When the designer has been agreed upon, it is well to enter into some simple form of contract as a record for both parties. This need not be elaborate, but should include costs, dates, subjects and memorial inscriptions, details which can lead to so many little misunderstandings, even among the best of friends. For after all, the contract with the craftsman is at most a friendly agreement based on terms of mutual satisfaction and respect.



### *The Cost of Windows*

**A**N important consideration is the cost of a building's fenestration. Many windows are memorials to loved ones who have gone and the expense of these is of course borne by the donor. Other windows are ordered and the expense defrayed by wealthy members of a church; or by a particular group connected with the church. In many instances money is raised by various church activities and contributions from members.

There is a tremendous range of possible cost for any window, depending upon the simplicity or complexity of its design and subject material. A distinguished window, like any other work of art, cannot be valued in terms of size. But prices are not prohibitive and no church official or group need deny their House of God its crown of jewels.

If sufficient funds are not immediately available, substitute or temporary windows of simple leaded pattern are often installed and their contrast serves as an incentive for the complete fenestration in stained glass.

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## *Glossary*

**AISLE** — A passageway leading to seats; but in large churches, a subdivision parallel to the nave, one aisle on either side of the nave, — hence the aisle windows.

**BAPTISTRY** — The portion of the church containing the font.

**BAY** — The space between one column and another, or one complete transverse unit of the architecture.

**CANOPY** — Architectural ornament suggesting a carved niche in which a figure is placed. It was common in all periods of mediaeval windows.

**CHANCEL** — The portion of the church often occupied by the choir stalls and the clergy.

**CLERESTORY** — The upper portion of the nave, extending above or clear of the side aisles.

**FAÇADE** — The front of a building.

**FULL SIZE** — The measurement of a window opening into the farthest point occupied by the glass, that is, into the depth of the groove or rebate.

**LANCET** — Long narrow window opening with a pointed arch. These occur singly or grouped in a single window, with or without tracery. A famous early example is the “ Five Sisters ” in York Cathedral.

**MULLION** — The vertical bars dividing a window into sections.

**NARTHEX** — The vestibule or division of the church between the entrance and the nave.

**NARTHEX SCREEN** — The partition between the narthex and nave.

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NAVE — The long central portion of the church auditorium.

REREDOS — The screen at the back of the altar.

ROSE WINDOW — A circular window divided into compartments by mullions or tracery radiating from the center, suggesting the petals of a flower. Some early examples have tracery in the form of spokes and are better called wheel windows. The term is often extended to include any circular window.

SACRISTY — A room in which the clergy may prepare for the service and where the sacred vessels and vestments are kept.

SANCTUARY — The front of the church containing the altar or communion table, pulpit, lectern and sometimes the choir stalls.

SIGHT OR DAYLIGHT SIZE — The measurement of a window opening to the face of the frame that can be seen in the light.

TRACERY — The ornamental frames or divisions at the top of a Gothic window, and the openings formed thereby.

TRANSEPT — A transverse section crossing the main nave.

TYMPANUM — The triangular space in a gable end or above the door, sometimes containing a window.

*Code of Ethics*  
*of The Stained Glass Association of America*

**I**NASMUCH as the Stained Glass Craft is one of the handmaids of Architecture, this Association favors the principle of architectural direction in the matter of the selection and purchase of stained glass.

We believe that the best interests of the client and of the craft are served when the number of craftsmen invited to submit sketches is held to the smallest possible number with a maximum of three bidders.

We believe that ideal conditions will prevail when only one craftsman studies the problem with the Architect and owner. This condition fosters mutual confidence as well as the most practical and economical procedure. Should this craftsman fail to satisfy the Architect or owner with his sketches, he should be willing to withdraw, without compensation, thus permitting another craftsman to enjoy the full cooperation of the owner.

When more than one craftsman is invited to submit sketches, we urgently recommend issuance of a formal invitation giving the following information:

1. The names of the craftsmen invited.
2. The price per square foot or the price per window contemplated.
3. The size and number of sketches required.
4. The date on which submissions are to be received.













