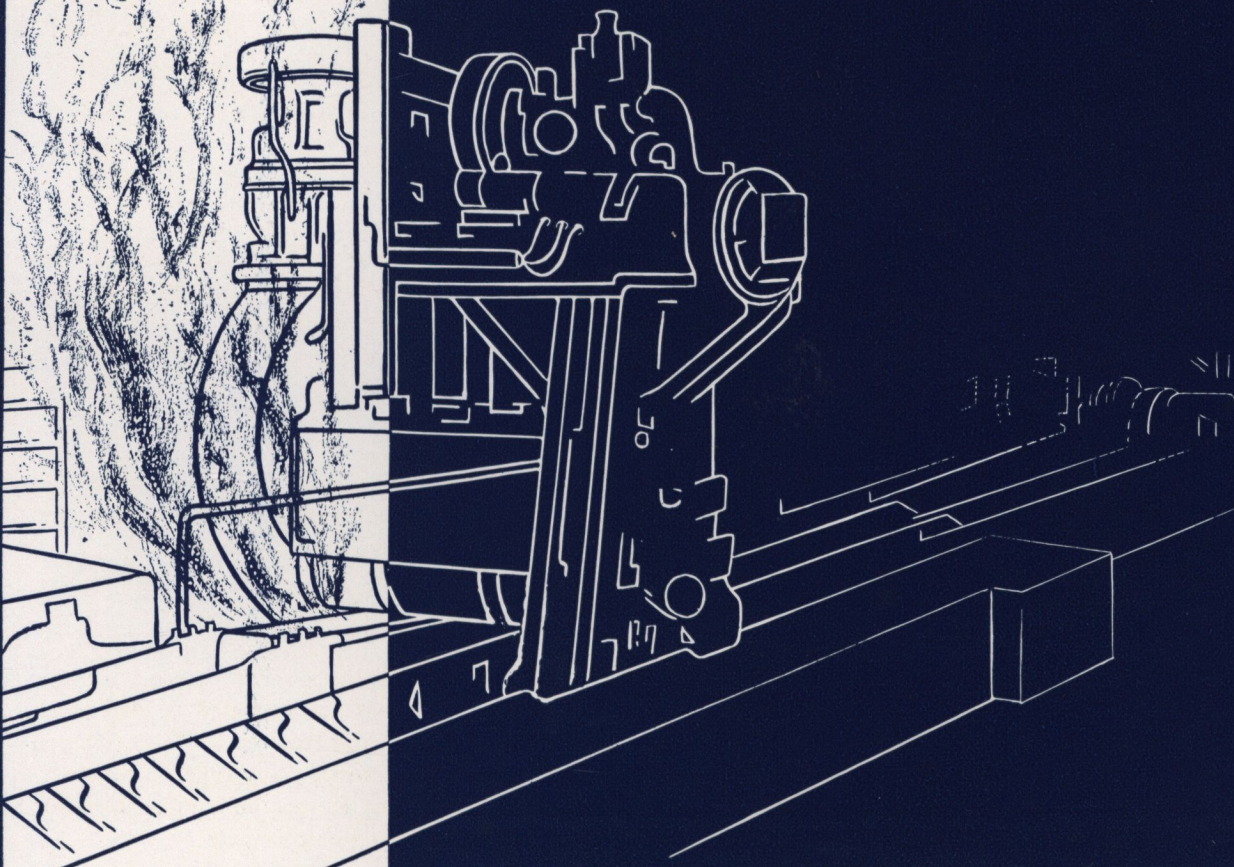




REPUBLIC

STEEL CORPORATION



ENDURO

REPUBLIC'S PERFECTED
STAINLESS STEEL

Licensed under Chemical
Foundation Patents Nos.
1316817 and 1339378.

FOREWORD

MOST architects who have contemplated using stainless steel in the past have been hampered by lack of accurate basic information which would enable them to select and specify intelligently the particular type of stainless best suited to given requirements. In compiling the information contained herein it has been the purpose of REPUBLIC STEEL CORPORATION to endeavor to remove some of the mystery and confusion which have heretofore surrounded the general subject of stainless steel for architectural uses and to present in non-technical form—so far as possible—such data as will permit the architect to differentiate between the various types of stainless steel and better appreciate the unusual characteristics and wide range of possible applications of this newest of metals.

ARCHITECTURAL SERVICE

In the discussions on the pages which follow emphasis has been laid on the necessity for selecting the proper type of steel to meet the particular conditions of the use contemplated. To assist the architect in specifying that type which will most satisfactorily meet his requirements, we offer the services of the Metallurgical Department of Alloy Steel Division, REPUBLIC STEEL CORPORATION, with its completely equipped modern laboratories where authorities are continually studying every factor connected with the production and application of stainless steels and where the best of laboratory equipment and specialized advice is freely available.

In connection with the uses of stainless steels shown and described herein it should be borne in mind that REPUBLIC STEEL CORPORATION does not sell or furnish the products direct. The Corporation produces only the unfinished material which is fabricated by others. Any of the district sales offices listed on the back cover will be glad to cooperate with the architect and suggest fabricators who are experienced and qualified to handle the work. They will also advise the architect on questions of specifying, detailing and installation.

For such advice or assistance please call the Sales Office or the distributor nearest you or write to the Alloy Steel Division of the Corporation at Massillon, Ohio. Samples (3x5 in.) of various finishes will be furnished any architect on request.

TONCAN IRON

On pages 17 to 23 of this catalog will be found a brief description of Toncan Iron and Toncan Iron Products which are of particular interest to the architect, engineer and contractor. Included also are data on Toncan Iron Enameling Sheets which are finding a wide variety of architectural applications.

Data on Republic Steel Pipe and Toncan Iron Pipe will be found elsewhere in this file.

ENDURO STAINLESS STEEL SHAPES AND SIZES

Enduro Stainless Steel is furnished in the forms listed below. In addition to these Enduro may be cast and the architect will find many uses for which cast stainless steels are especially appropriate. All shapes are made by fabrication and either formed, rolled or drawn. In the present state of the art Enduro does not lend itself readily to the extruding operation. For detailed information consult any Enduro Stainless Steel Distributor or any of the Republic District Sales Offices listed on the back cover.

Rounds, hot rolled, cold drawn, centerless ground and polished.

Squares, hot rolled and cold drawn.

Hexagons, hot rolled and cold drawn.

Flats, hot rolled and cold drawn.

Sheets, standard gauges and sizes, annealed and

pickled, polished one side and polished both sides.

Plates in practically any size and thickness obtainable in plain steel; large size one-piece flanged and dished heads.

Strip, hot rolled, and cold rolled, and polished.

Forging blanks, any reasonable weight or size.

Shapes, angles, channels, I-beams, etc. Sizes on application.

Tubing, seamless, Republic electric resistance welded. Pickled or polished.

Welding Rods, $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in. diameter. Coated and uncoated carried in stock for electric and acetylene welding.

Castings can be furnished of Enduro 18-8 analysis by special arrangement.

Bolts and nuts, rivets, screws, nails, tacks, spikes, wire and many other items of Enduro Stainless Steel can be obtained from various sources. Names of manufacturers will be gladly furnished.

● ENDURO STAINLESS STEEL

ENDURO STAINLESS STEEL

"Enduro" is the trade name identifying the group of stainless steels perfected by Republic Steel Corporation at its Alloy Steel Division, Massillon, Ohio. These alloys are silvery-white in appearance and cannot chip, crack or wear thin as they are the same metal all the way through. They do not tarnish, corrode or become dull when properly applied. They can be worked and fabricated for any purpose. They can be given a number of different finishes or combinations, or may be etched and enameled to produce unusually beautiful effects. They may be combined with colored porcelain enamel (or with other metals) to produce a wide variety of pleasing effects. In brief, the unusual properties of Enduro Stainless Steels indicate their use not only for the finest of decorative effects but also for every application subject to possible corrosion.

Probably few persons not directly connected with the industry appreciate the wide range of uses now being made of stainless steel. A list of these would be a roll call of almost every manufacturing process in the United States. From cooking utensils to automobile parts, from golf clubs to bank vaults, stainless steel is finding new applications every day. In the engineering, chemical, power and oil refining fields, the corrosion- and abrasion-resistance and strength of stainless steel at high temperatures are essential.

Although chromium, the element, was discovered in 1789 and the acid-resisting properties of chromium-iron alloy appreciated as early as 1821, it was not until within the past twenty years that commercial application has been made of such alloys. Since 1913 hundreds of patents have been granted both in this country and abroad for various stainless alloys.

Naturally this flood of patents has led to considerable confusion, particularly among laymen, as it seems that nearly every steel manufacturer has entered the stainless field making this or that analysis. Rash claims have been made regarding the performance of these alloys and far too often the application has been made to suit the alloy on hand rather than applying a specific alloy which would give the desired results.

While different trade designations are still used by various manufacturers, standard type numbers have been assigned to all stainless steel analyses. This has been done under the supervision of the American Iron and Steel Institute.

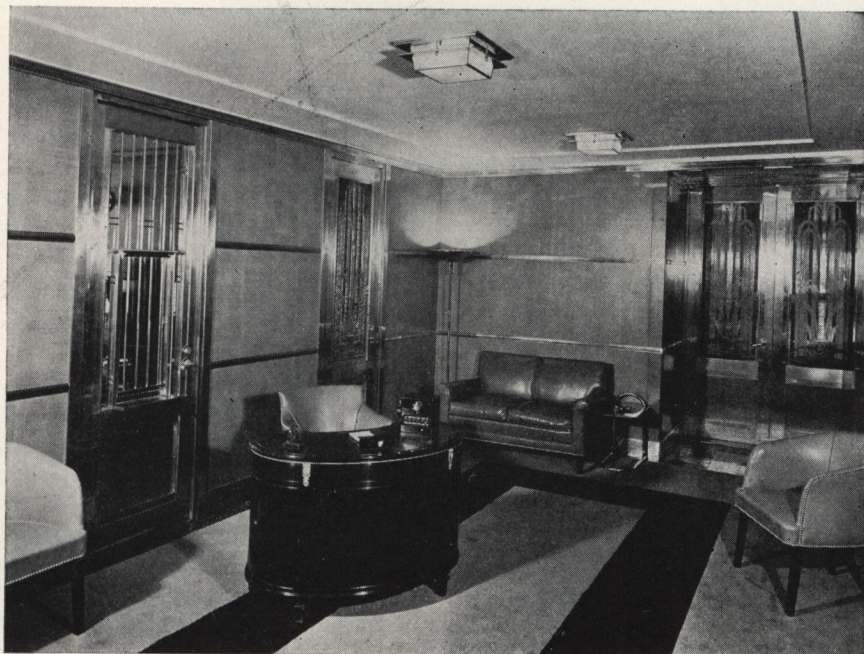
Types of Stainless Steels

Technically there is a distinction between stainless iron and stainless steel, although latter term is popularly, if erroneously, used to designate all stainless alloys.

Stainless Iron generally is an alloy of iron and chromium, or of iron, chromium and nickel, with a *very low carbon* content. The stainless properties of the alloy are due to the ability of chromium to form with iron a solid solution which is resistant to the various corrosive media. It is essential that sufficient chromium be present in solid solution to ensure stainless properties. The chromium content of Enduro Stainless Irons has been adjusted accordingly.

Stainless irons, or stainless steels as they are popularly known, as a class do not respond to hardening by heat treatment. Neither do they require special heat treatment other than that received at the mill to develop stainless properties. Stainless steel lends itself to deep drawing and other forming operations.

To meet the demand for corrosion-resisting alloys suitable for a wide variety of specific purposes, Enduro Stainless Steel has been developed in a number of types. In this development, all factors affecting corrosion-resistance have been considered and their relative importance established. The result is a series of alloys possessing maximum corrosion-resistance and physical properties, consistent with ease of workability, for each field of application. Two of these steels were especially developed for architectural uses and are described in detail on the pages which follow.



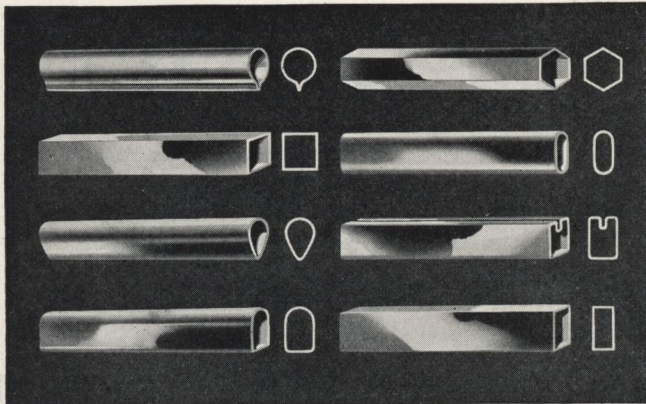
New York District Sales Offices of Republic Steel Corporation, Chrysler Building, New York, N. Y.
Designer—Kenneth D. Rippen

Enduro used for doors, lighting fixtures and bands on walls

ENDURO STAINLESS STEEL FOR ARCHITECTURAL USES

To attempt to list all the hundreds of possible architectural applications of Enduro Stainless Steel would be merely to catalogue the uses for any metal in any building for there is almost no place in which the usual metals are used where Enduro will not prove highly satisfactory. Not only does the beautiful, silvery-white lustre open for the designer an entirely new field of decorative possibilities because there is no coating to wear off, but the corrosion-resisting qualities indicate its use wherever there is liable to be danger of atmospheric attack. For example, Enduro has been used for decorative effects in some of the country's finest buildings and yet its qualities make it equally suitable for such practical purposes as boiler and heater smoke pipes where it has a life many times that of ordinary pipe with the consequent economy and freedom from trouble.

Of the many different types of alloys, two are of special interest to the architect because they are particu-



Some Standard Shapes of Enduro Tubing (in Addition to Standard Rounds) of Enduro Stainless Steel

Manufactured by Steel & Tubes, Inc., Cleveland, Ohio
Subsidiary of Republic Steel Corporation

larly suitable for architectural applications. These are Enduro 18-8 and Enduro AA. The former (Enduro 18-8) meets every architectural requirement and is generally used for such purposes. The latter (Enduro AA) is less expensive than Enduro 18-8 and is used to some extent for interior work. These two are the most sim-

ple to process of all the types and are used for applications requiring decided bends or draws or welds and for straight flat work.

It is realized that some architects may not be familiar with the many applications of Enduro now being made in the architectural field and the list below is included simply as indicative of the wide range of possibilities with this unusual metal.

- | | |
|---------------------------------------|-----------------------------------|
| Air Conditioning Equipment | Letters, Stamped, Formed and Cast |
| Awnings and Canopies | Lighting Fixtures |
| Balls for Flag Poles | Lintels, Window |
| Beer and Liquor Dispensing Equipment | Louvers |
| Blowers | Marine Ornamentation |
| Bolts and Nuts | Marques |
| Booths | Medallions |
| Boxes, Safe Deposit | Mirrors |
| Bulletin Board Frames | Moulding, Window |
| Cabinets | Moulding, Various |
| Cable, Wire | Mullions (Exterior and Interior) |
| Cages | Nails |
| Casements | Name Plates |
| Ceilings | Ornamental Metal Work |
| Chairs | Panels, Plain and Fluted |
| Channels | Partitions |
| Chimney Tops (to prevent down drafts) | Piers |
| Chute Covers | Pilasters |
| Chutes, Mail | Pillars |
| Clock Dials | Plaques |
| Columns | Play Ground Equipment |
| Conveyor Systems | Posts |
| Coping | Railing, Decorative |
| Cornices | Railing, Stair |
| Counter Covers | Refrigerators |
| Courses, Band | Risers, Stair |
| Crosses on Churches | Rings, Circular |
| Desks | Roofing |
| Display Cases (plain or refrigerated) | Rosettes |
| Domes | Safes |
| Door Jamb, Sashes and Moulding | Screens (Frames and Cloth) |
| Door Push Bars and Plates | Scroll Work |
| Doors, Elevator | Sheathing |
| Doors, Revolving | Shelving |
| Doors, Swinging | Shower Cabinets |
| Doors, Vault | Signs |
| Down Spouts | Sills, Window |
| Drinking Fountains | Sinks |
| Elevator Dials | Skylights |
| Entrances | Smoke Pipe for Furnace |
| Etched Panels | Soffits |
| Facades | Spandrels |
| Flashing | Spires |
| Floor Plates and Tread | Store Fronts |
| Flues | Structural Members |
| Frames, Advertisement | Tablets, Memorial |
| Gates | Theatre Equipment |
| Grilles, Radiator and Decorative | Towers |
| Gutters | Urns, Decorative |
| Hardware | Vaults |
| Hinges | Ventilators |
| Hoods, Range and Laboratory | Ventilating Ducts |
| Incinerators | Vestibules |
| Kick Plates, Door | Window Frames |
| Laboratory Equipment | Wire Cables |

ENDURO 18-8

Enduro 18-8 contains approximately 18 per cent of chromium and 8 per cent of nickel with carbon from .08-.20 per cent. The addition of nickel—a metal possessing in itself considerable corrosion-resistance—to the stainless analysis greatly increases the corrosion-resistance of the alloy, extending this resistance to a number of materials which attack stainless chromium iron, to the point of complete immunity from attack. The addition of nickel also increases resistance to scaling at high temperatures, reduces grain growth, and at

the same time lessens embrittlement after long service at high temperatures. Metallurgically, the effect of the nickel is to produce an alloy of the stable austenitic type; characterized by extraordinary toughness and ductility, no capacity for hardening under heat treatment, high resistance to impact, and the property of being non-magnetic. To take full advantage of the addition of nickel, certain processing is necessary and this forms an important part of the Enduro production method.

● ENDURO STAINLESS STEEL

Typical Analysis and Average Physical Properties of Enduro 18-8

Analysis

Carbon	over .08-.20
Chromium	17.0-19.0%
Nickel	7.0-9.0%
Silicon	under .75%
Manganese	under .60%
Sulphur	under .030%
Phosphorus	under .030%
Weight—virtually the same as steel—0.2833 lb. per cubic inch.	
Thermal Conductivity expressed in calories per centimeter cubed: .035	
Resistance to High Temperature Scaling	

Continuous Service 1600° F.	
Intermittent Service 1450° F.	
Co-efficient of Linear Expansion—Temperature x10 ⁻⁶	
0- 100° C. =	16.0
0- 300° C. =	17.0
0- 600° C. =	18.0
0-1000° C. =	20.0
Melting Point (approximately 2560° F.)	

Cold working increases the ultimate strength and yield points over those shown above but reduces ductility.

Average Physical Properties Annealed (24 Gauge Sheet)

Ultimate Strength.....	85,000 lbs. per sq. in.
Yield Point.....	35,000 lbs. per sq. in.
Elongation in 2 in.....	55.0%
Elongation in 4 in.....	50.0%
Elongation in 8 in.....	45.0%
Rockwell B.....	.80 0
Olsen Cup Test.....	.450-.500

(Lighter gauges will have lower cup values)

Average Physical Properties (Annealed Round Bar Stock Up To 2 in. Rd.)

Ultimate Strength.....	85,000 lbs. per sq. in.
Yield Point.....	35,000 lbs. per sq. in.
Elongation in 2 in.....	55.0%
Red. Area.....	.65.0%
Rockwell B.....	.80
Brinell.....	156

(Larger sizes will have lower strength values)

It is not uncommon to find 250,000 lbs. tensile strength, 2% elongation and 40-45 Rockwell "C" hardness in cold drawn 18-8 wire. Cold rolled strip having 150,000 lbs. ultimate strength, with 9 to 15% elongation in 2 in., can be obtained. It will stand a 180° bend across the grain of the metal and 120° to 180° with the grain.

Fabricating Enduro 18-8

The proper fabrication of any metal is a most important part of a successful installation and for this reason the data below are presented for the information of the architect who may be unfamiliar with the best methods of working and forming Enduro 18-8. Enduro 18-8 is one of the finer metals and should be handled similarly to other high grade materials rather than attempt to fabricate by employing methods generally used on common iron or steel products.

Deep Drawing, Punching and Shearing

Enduro 18-8 is well suited for performing these operations. Its extremely high elongation and low yield point are indicative of what may be expected of this alloy as compared to regular deep drawing steel. It should, however, be pointed out that Enduro 18-8 work hardens very rapidly and to a much higher degree than does regular drawing steel. For this reason it is necessary to perform as much work as possible in a single drawing operation and to reanneal between operations. The blanks used should be of sufficient size not to require excessive ironing out in the dies to secure cup depth, as the work hardening characteristics of the alloy may cause high breakage loss as well as excessive wear on the dies. The use of a special lubricant of suitable consistency and body is quite important. A number of suitable drawing compounds is available from chemical supply concerns. Operation of the press should be as slow as possible. Die clearance should be about twice that used for steel or brass.

The work hardening characteristics and high tensile strength of Enduro 18-8 make it necessary to use more power in performing drawing operations than is required in forming and drawing steel of a similar gauge. A very close adjustment of shear blades and of clearance between punches and dies is recommended for punching and shearing operations. The power required will be greater for the reason previously given and it will be necessary to shear through the entire thickness of metal rather than permit it to snap off after a portion of the cross-section has been cut through, as occurs in punching most materials.

Riveting

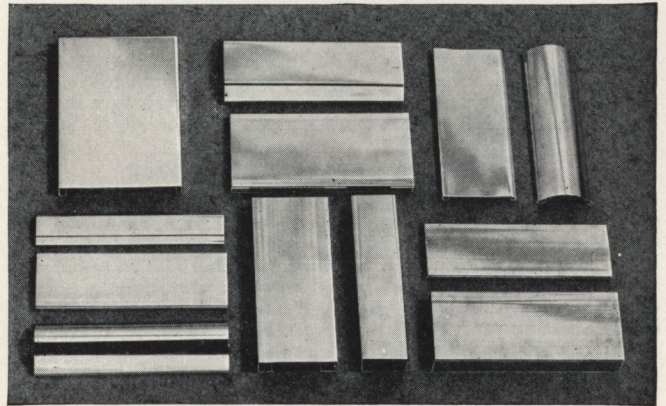
Enduro 18-8 is ideal material for rivets. As it does not harden on rapid cooling, nor develop coarse crystalline structure on heating, the more accurate temperature control required for straight chromium iron rivets is not necessary. Rivets when driven hot should be heated within a temperature range of 2100-2200° F. Smaller size rivets may be driven cold, as they remain tough and thoroughly dependable. Hot driving is recommended for rivets over 1/8 in. in diameter.

Welding

Enduro 18-8 may be welded by either the acetylene torch or electric arc, using specially prepared Enduro 18-8 welding rods or electrodes. It may also be spot and resistance welded, but cannot be forge or hammer welded. Seam welding of light gauge sheets is readily accomplished. Having no capacity for harden-

ing, welds remain tough and ductile and do not develop the coarse, "weak" crystalline structure characteristic of the straight chromium iron alloys.

For acetylene welding, uncoated welding rods should be used. With plates and other heavy materials, chamfer the edges to be welded and place these a small distance apart. Build up a bead between these edges, keeping the flame pointed in the direction



Some Standard Shapes of Enduro Stainless Steel Moldings

of welding so as to preheat the work. Use a slightly reducing flame, and see that it is no larger than necessary for the work to be done. For electric arc welding, specially coated rods or electrodes must be used. Reverse polarity (electrode must be positive and work the negative pole) and regulate the machine to give the same or lower voltage than would be used with plain steel rods, and with sufficient current to give good fusion. Definite instructions cannot be given as much will depend upon the character of the work and the type of machine used. (See Enduro Welding Booklet for further information.)

While welds made with Enduro 18-8 are naturally tough and ductile, the annealing treatment previously mentioned is strongly recommended if the welded material is to withstand severe corrosive attack. This treatment will tend to remove the difference in structure between the weld and the adjacent metal, which is the primary cause of local attack in welded structures. Where acid corrosion may be encountered and annealing of the weld is not possible, Enduro 18-8-S should be used.

Soldering

Enduro 18-8 may be soldered without difficulty, producing firm, strong joints. For pickled finish sheets, the ordinary muriatic acid, cut with zinc, may be used. However, better results will be obtained with special commercial fluxes, used with ordinary solder, and by pursuing the same procedure as with copper, tin, terne, etc. For polished sheets, the surfaces to be joined should be roughened with a coarse emery wheel before tinning.

The metal comprising the joints should be properly tinned before assembly. The half tin, half lead type of solder may be used but solder with higher tin content such as 75% tin—25% lead is recommended because it does not discolor as rapidly under atmospheric exposure. On account of the low thermal conductivity, use a large soldering iron which will have sufficient heat capacity to heat the metal thoroughly. Immediately after soldering, *all traces of acid must be thoroughly removed* by washing with soap and water to which has been added some washing soda, as the acid attacks the metal readily and will stain if not removed. Soldering should not be depended upon for strength but simply to seal the joint. Riveting, lock seaming or spot welding should be used for strength. Rivets should be tinned to insure adhesion of the solder before driving which, of course, is done cold.

Brazing and Silver Soldering

We recommend welding rather than brazing whenever possible due to the excellent welding properties of 18-8 and to the possibility of intercrystalline penetration of the brazing alloy. This lowers corrosion-resistance and causes embrittlement of the joint under wet corrosive conditions by favoring electrolytic action. Brazing must be carefully done to prevent the penetration of brazing alloy into the grain boundaries of the metal.

For brazing and silver soldering proceed in the usual manner, observing the precaution of having the metal just sufficiently hot for good adhesion. Special stainless steel brazing flux should be used.

A satisfactory flux for brazing or silver soldering may be made by mixing one part of borax with two parts of sodium or potassium bi-fluoride. Use either dry or in a water or alcohol paste, applying a small quantity to the parts to be joined before heating. Then proceed with ordinary brazing material or silver solders.

Machining, Sawing and Drilling

Being an austenitic alloy, Enduro 18-8 is tough and somewhat difficult to machine. In order to overcome the machining difficulties heretofore confronted, Republic has produced a free machining 18-8 alloy which is termed ENDURO 18-8-FM. This free machining alloy, as its name suggests, simplifies to a great extent turning, milling, boring and drilling operations. Its corrosion-resisting properties are comparable to those of the regular ENDURO 18-8. Best results are obtained with slow cutting speeds and moderately heavy cuts. Tools must be ground and kept sharp, and with a steep side and lip rake (at least 15 degrees). In threading, arrange so that four or five teeth engage, instead of the usual two or three.

Drilling should be done with a high speed steel drill. Best results are obtained when the drill is ground somewhat flatter than is customary. The drill should cut all the time, and in laying out work as small a mark as possible is advisable, as the punch will work harden the alloy and make it difficult to start the drill. The speed of the drill should be about one-half that used in the case of mild steel. When drilling deep holes or hollow boring, a compound of high sulphur base oil with the addition of turpentine will prove of value.

In sawing, a high speed steel blade should be used of the fine tooth, wavy type. When possible a circular type saw should be used.

When drilling and sawing use constant pressure. Permitting the saw or drill to ride the surface causes work hardening.

Protecting the Surface of Polished Enduro During Forming—Drawing—Moulding—Construction and Erection

Many applications of Enduro permit the use of mill polished sheets such as No. 4 finish, No. 6 Tampico finish, No. 7 finish and No. 8 mirror finish. A few of these applications are—soda fountain and bar equipment, dairy equipment, meat packing equipment, hospital and kitchen equipment, restaurant and cafeteria equipment and for structural and decorative purposes such as used on the Empire State and Chrysler Buildings, and many others.

In nearly every instance, sheets for the type of work mentioned above are polished in our Special Products Division, where great care is taken to obtain the desired finish—free from pits, scratches and other marks.



Photo, Hendrich-Blessing Studio
Amalgamated Trust & Savings Bank, Chicago, Ill.
Architects—Holabird & Root

Enduro used for sheathing on vault, fence and gate and on entrance to bank

In the ultimate use of these polished sheets there are, of course, some cases where no fabrication is done on the material, and it is used in the flat. Only careful handling is then required to preserve the lustrous finish. It will be found, however, that in most cases subsequent operations will be performed on brakes or presses. Under these conditions it is essential that precautions be taken to eliminate marks, scratches and dents. It has been found that it simplifies the problem greatly to prevent marring the sheet at the start rather than to polish out the marks that have appeared through improper protection in the dies. It is quite difficult to match by hand, on a formed object, the finish that has been put on the sheet at the mill with our polishing machines.

While we do not maintain that it is possible entirely to prevent scratching and galling on all types of work, we feel that everything possible should be done to minimize the possibility of their formation.

Preventing Injury During Fabrication—Is accomplished by proper lubrication. Several methods are being used which will be noted here, and the fabricator should use the one best adapted to his particular operations.

The first consideration should be given to the condition of the dies. They should be well polished and at the first sign of any pickup of the metal, the press or brake should be stopped and the dies stoned and polished.

One of the most effective lubricants for use on Enduro is a mixture of Lithopone and linseed oil. It should be applied generously. Lithopone is obtainable from Grasselli Chemical Co. and the New Jersey Zinc Co., in powder form, and should be mixed with linseed oil to form a liquid of fairly heavy consistency. Benzine may be used as a thinner, and sometimes paraffin oil is substituted for linseed oil, although in our opinion linseed oil is preferable. We advise the use of Lithopone when the forming is severe, and where special care is necessary.

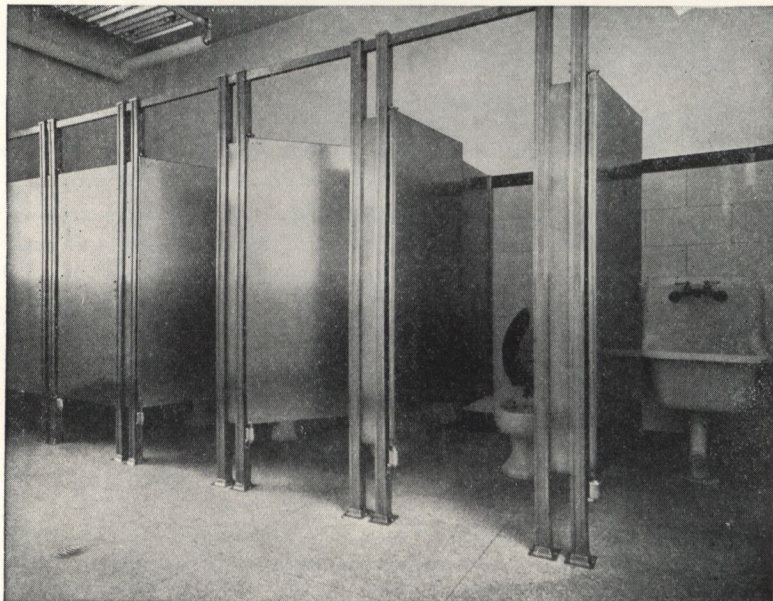
Lithopone may be removed from the sheet after forming by the use of benzine or kerosene.

There are now available on the market, special stainless steel lubricants using Lithopone as a base.

Another method which preserves the polished finish of the metal is the application of adhesive tape to the dies. This method can be used where the work applied to the metal is not severe, such as in bends on brakes. We do not recommend its use for deep drawing. The merit of this type of protection can easily be realized, as it prevents direct contact between the polished surface of the Enduro sheet and the hardened steel of the dies.

Following this same line of thought, the use of thin paper between the polished metal and the die has worked well in several cases. Wax paper, oiled paper, and cellophane have been used

● ENDURO STAINLESS STEEL



St. Colman's Parochial School, Watervliet, N. Y.
Architects—Gander, Gander and Gander
Enduro Toilet Partitions

with marked success in the elimination of die scratches. The paper is usually used as an adjunct to the lubricant.

Protection of Polished Enduro During Building Construction—The wide use of polished Enduro for exterior decorative purposes in building construction has made necessary the

means of protecting it from what we will call "building filth," meaning plaster, cement, concrete, ashes, rust from steel work and other contaminations with which the polished sheet may come in contact during the erection of a building.

Several of the large paint concerns have developed special lacquers which will protect the sheet for a period of one year or longer from the effects of "building filth." The lacquer can be removed at the completion of the building, or it may be allowed to wear off from the effects of the weather. The lacquers we approve will not whiten through exposure to weather.

The method used on the Richman Bros. Building, recently completed in Detroit, was the pasting of Manila paper over the entire exposed surface of the formed sheet. Following the completion of the building, the paper was removed with water—and the surface of the metal found to be in perfect condition.

Passivation

The passivation treatment consists of immersing the material in a 25% by volume solution of nitric acid and water at a temperature of 120–125° F. for 15–20 minutes. The purpose of the passivation treatment is to remove any trace of iron or steel which has become abraded on the stainless steel due either to shearing or contact with dies in forming operations. The nitric acid bath will remove this film of iron without affecting the surface of the polished stainless steel.

The tank for holding the nitric acid solution can be made from wood, stainless steel, earthenware or rubber.

Bulletins

Bulletins covering in detail each of the operations and treatments which may be applied to Enduro Stainless Steels are available and will be sent gladly to any architect on request.

ENDURO AA

Enduro AA is a straight chromium alloy. It is a fairly ductile, non-hardening alloy with physical properties equal to a high grade medium carbon steel, with resistance to general corrosion and oxidation at high temperatures.

It is recommended only for interior applications as its resistance to corrosion is not equal to 18-8.

Fabrication in general is similar to 18-8 except it does not possess the same degree of ductility or welding properties, and does not work harden to any great extent.

All welded joints in straight chromium alloys (without the addition of nickel) have a tendency to embrittlement at and adjacent to the weld, due to the high temperatures required for welding, which causes excessive grain growth.

Typical Analysis and Average Physical Properties of Enduro AA

Analysis

Carbon	max. .12
Chromium	15.0–18.0
Silicon	max. .50
Manganese	max. .50
Sulphur	max. .03
Phosphorus	max. .03
Nickel	max. .25
Weight per cubic inch—virtually the same as steel. (.277 lbs. per cu. in.)	
Thermal Conductivity expressed in calories per centimeter cubed: .045	
Resistance to High Temperature Sealing—	
Continuous Service 1500° F.	
Intermittent Service 1600° F.	
Co-efficient of Linear Expansion—Temperature x10 ⁻⁶	
0–100° C. = 9.6	
0–300° C. = 10.1	
0–600° C. = 10.9	
0–800° C. = 11.2	
Melting Point—2650°–2700° F.	

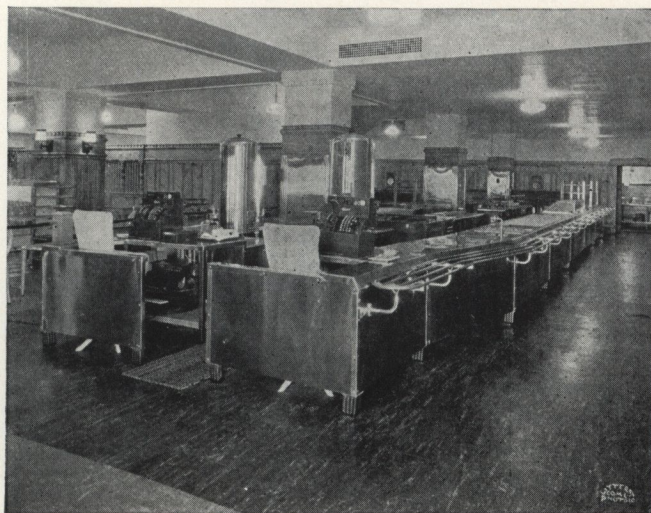
Average Physical Properties (Annealed Sheet)

Ultimate Strength	80,000 lbs. per sq. in.
Yield Point	50,000 lbs. per sq. in.

Elongation in 2 in.....	26.0%
Elongation in 4 in.....	22.0%
Elongation in 8 in.....	18.0%
Rockwell B .....	.80

Average Physical Properties (Annealed Round Bar Stock)

Ultimate Strength	80,000 lbs. per sq. in.
Yield Point	50,000 lbs. per sq. in.
Elongation in 2 in.....	25.0%
Reduction of Area	60.0%
Brinell	160



Rice Hotel Cafeteria, Houston, Texas
Architect—A. C. Finn

Enduro used for counter tops, panels, trim, tables, urn stands, structural column inclosures and many other purposes

FINISHES OF ENDURO STEEL

Of primary importance to the architect in designing with Enduro Stainless Steel are the many different finishes in which this unusual metal may be obtained. Unlike plated materials Enduro is the same beautiful color throughout and has no coating to wear off. As it is proof against tarnishing and corrosive attacks, it can be used with every assurance that the original effect will be retained during the entire life of the building.

The various sheet finishes are designated as follows:

- No. 1 Hot rolled annealed and pickled
- No. 2-B Full Finish (Bright cold rolled)
- No. 2-D Full Finish (Dull cold rolled)
- No. 4 Standard Polish on one side or both sides
- No. 6 Standard Polish Tampico Brushed on one or both sides
- No. 7 High Lustre Polish on one or both sides
- No. 8 Mirror Finish on one or both sides

Although the architect will probably select the finish to produce the special effect desired, certain restrictions should be borne in mind and the advice of Republic Steel Corporation representatives or distributors secured on any problems not covered here. For example, the finish possible on the stock will depend to a considerable extent on the amount of forming necessary. It is inadvisable to use polished sheets for extra deep drawing operations where score marks from dies are likely to occur in forming or where it is necessary to reanneal to make a second drawing operation. Our No. 1 Finish should be used under these conditions.

Numerous other applications of the No. 1 Finish may be made at points where appearance is not a primary factor but where corrosion-resistance is important, such as mail chutes, tanks, tubing and a variety of other uses.

No. 2B Finish and No. 2D Finish are the same as No. 1 except that they have a slightly higher finish due to cold roll processing.

Polished finish should be used only where stock will be employed without further working, where the degree of working is small or where finish can be protected so that excessive refinishing is unnecessary.

No. 4 Finish being ground and polished is very satisfactory for interior application. It possesses a ground surface appearance with a medium lustre and is considered the best commercial type of finish for such applications as bank vaults, restaurant and

soda fountain equipment, sterilizers, laundry machinery, packing house refrigerators and equipment, cold storage, canning and preserving equipment, trim for cabinets and numerous other places where a fairly high lustre and ease of cleaning are desired.

No. 6 Tampico Brushed Finish has found more favor for exterior application than No. 4 Finish. No. 6 Finish has a silvery lustre and does not have as high a reflectivity. It can often be used to blend in conjunction with finishes of higher lustre or other metals. Higher lustre finishes such as No. 7, are obtainable and are similar to No. 4 with the exception that the lustre obtained by buffing is much brighter.

No. 8 Finish is the highest obtainable in commercial steel practice. All of the grinding lines are removed and a sheet of high reflectivity is obtained. This finish is used for mirrors and for trim where highest lustre is required.

It may be interesting to review the processing procedure applied to the Enduro sheets used on the Chrysler and Empire State Buildings and more recently on the Richman Bros. Building, Detroit, and the Insurance Company of North America Building, New York, as these may be considered typical of such architectural applications. The sheets, which were of Enduro 18-8, after being hot rolled, annealed and pickled, were rough ground with No. 80 grit used dry, followed by successive grease wheels of 100-120, etc., until the finish desired was obtained. The Chrysler sheets received a relatively high finish followed by buffing and passivation (in nitric acid).

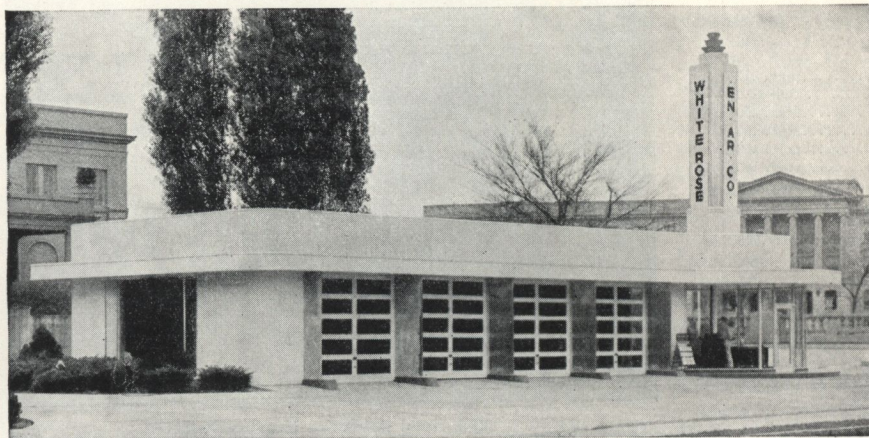
The Empire State Building, Richman Bros. Building, and the Insurance Company of North America Building sheets had a medium finish, followed by a special wheel to dull the lustre, giving a No. 6 Tampico finish. These sheets likewise were given the passivation treatment; then after being formed into panels at the fabricators' plants, they were again passivated, following the removal of the drawing compound by the use of gasoline and whitening. In the foregoing descriptions it has been impossible to give more than a general idea of the appearance of each and the differences between the various effects possible. It has also been found impossible to show these finishes by half-tone engravings. For these reasons we suggest that the architect secure samples of the various finishes from Republic Sales Offices or Enduro Distributors before making a definite selection.

Enduro Stainless Steel Strip

The various finishes of Enduro Stainless Steel strip are designated as follows:

- No. 1 Cold rolled, annealed and pickled. Surface has dull sheen.
- No. 2 Cold rolled, annealed, pickled and given light skin pass. Somewhat brighter surface than No. 1.
- No. 3 Cold rolled, annealed and pickled, with buffing operation. Surface has medium bright lustre.

Enduro Stainless Steel strip is also available in polished finishes, designated as and comparable with sheet finishes Nos. 4, 6, 7 and 8.



National Refining Co. Service Station, Indianapolis, Ind. Architects—Pierre & Wright.
Enduro for Coping and to encase five pilasters at Service Entrances

STORE FRONTS OF ENDURO

In the present trend toward modernism in store front design usually involving the use of gleaming white metals, Enduro fits perfectly. All store front manufacturers in SWEET'S Catalog File are familiar with the fabrication of Enduro and are able to advise architects on the use of Enduro and to fabricate it to the architect's design.

On the preceding pages have been outlined the many characteristics and properties of Enduro Stainless Steel which make it particularly suitable for architectural purposes. Attractive appearance, complete resistance to corrosion and tarnishing, and a wide variety of finishes make Enduro the ideal material for the finest of decorative effects as well as for every purpose subject to possible corrosion.

Because of these qualities it is natural that Enduro has come to occupy a most important place in modern store front construction. In designing a store front the architect plans for a very definite effect. To accomplish this he must use materials which will be striking in appearance, which will contribute to the attention getting character of the complete design and yet which will not detract from the principal

purpose of any window, namely, the sales-influencing display of goods.

Of utmost importance to the designer as well as to the store owner is the matter of upkeep or cleaning. No architect wishes to develop a carefully studied design and then find that, in a short time, the entire effect is ruined by uncared for, unpolished metals, dirty glass, or rusty trim. On the other hand the owner does not wish to feel that his store front is a continual source of upkeep expense. It is essential, therefore, that the architect select a metal which will retain its original beauty as long as it is in place and one which will require only a minimum of cleaning. Enduro will withstand the corrosive action of acids and smoke and rain water. Washing down the window glass, with its accumulated dust, cannot stain the gleaming surface of Enduro Stainless Steel.



S. S. Kresge Co., Cleveland, Ohio
Trim on front windows, trim on front, flashing and canopy over sign of Enduro.
Background of sign is Porcelain Enamel

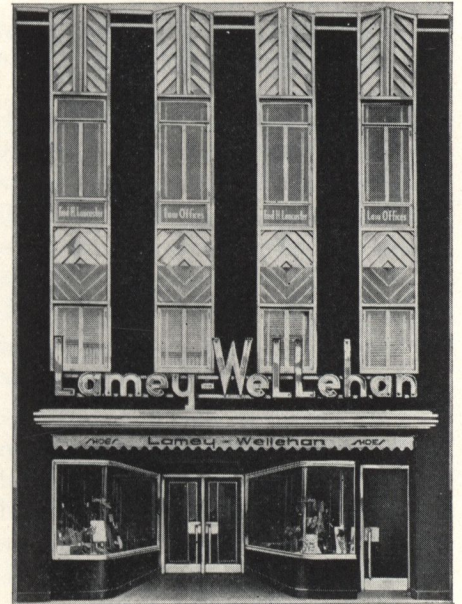


Bromley Theatre, Philadelphia, Pa.
Architects—Thalheimer & Weitz
Ornamental plaques, poster frames and drinking fountain of Enduro.
Ticket booth of Porcelain Enameled Iron with Enduro strips



Walter's Restaurant, Philadelphia, Penna.
Architects—Thalheimer & Weitz

Enduro for the sign. On interior Enduro was used for lighting fixtures and wall mirrors and for several purposes on the two bars



Lamey-Wellehan Store,
Lewiston, Maine

Architects—H. S. Coombs and
Alonzo J. Harriman

*Enduro for window moulding,
push plates and bars, cornice, sign
and for mullions between win-
dows on second and third floors*



George B. Peck Department Store, Kansas City, Mo.
Architects—Bovard & Drake

Enduro used for signs, marquee and store front



"Zapateria Del Leon," Buenos Aires, Argentine Republic
Enduro used for the sign



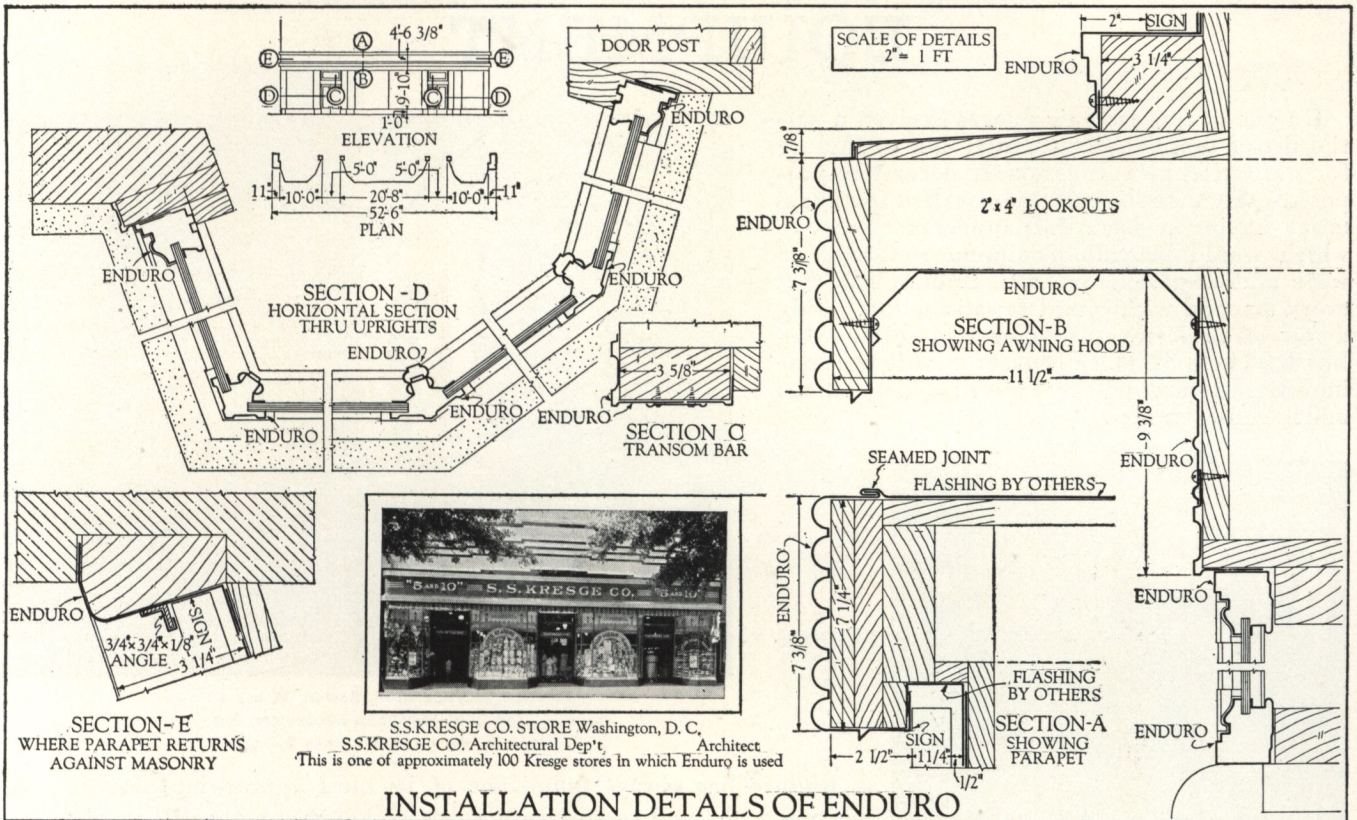
The Pennsylvania Diamond Exchange, Philadelphia, Penna.
Architect—Solomon Kaplan

*Enduro for grille on doors, letters in sign, paneling under windows
and trim above windows and doors*

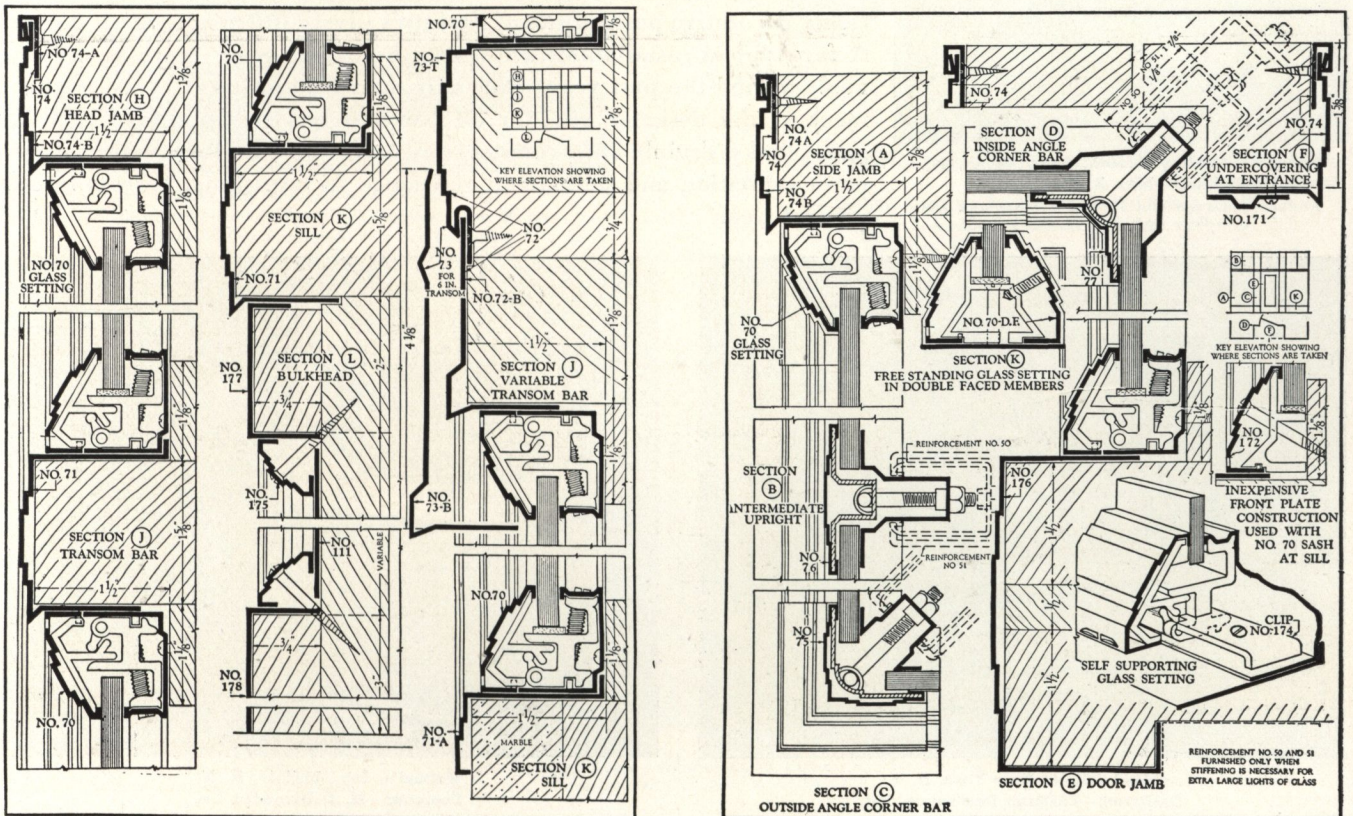
● ENDURO STAINLESS STEEL

STORE FRONT CONSTRUCTION OF ENDURO STAINLESS STEEL

Fabricated by Sioux Metal Products Co., Sioux City, Iowa

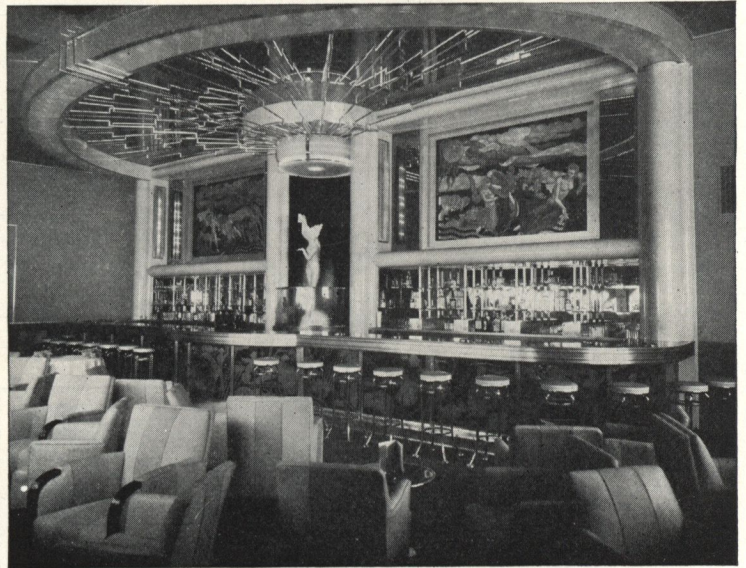


"Himco" No. 70—The Himmel Brothers Co., New Haven, Conn.



ENDURO FOR BARS AND BAR EQUIPMENT

On one of the preceding pages is given a partial list of the many and varied uses of Enduro for utilitarian as well as purely decorative purposes. Whether the conditions called for a material having a beautiful appearance or one which would provide maximum resistance to wear and corrosion or both, Enduro has met every demand with complete satisfaction. Only a few of these uses are shown in this catalog but REPUBLIC STEEL CORPORATION will welcome inquiries regarding any specific installations under consideration.



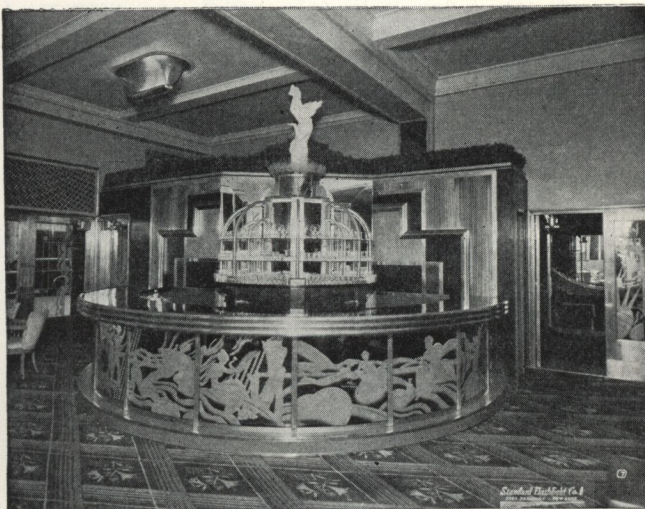
Mayfair Club, Boston, Mass.
Designer—Eastman Decorators, Inc
Enduro for bar work board



Angela Colonna
216-26 S. 11th St. Phila.
Philadelphia, Pa.

Twentieth Century Tavern, Philadelphia, Pa.
Architect—Max A. Bernhardt
Enduro beverage and serving cabinet and the complete unit behind the bar

Enduro has always found one of its most appropriate uses in connection with food service equipment and it was natural that, with the advent of Repeal, Enduro should become a favorite metal for bar equipment. However, the architect's attention is particularly directed to the richly decorative possibilities of Enduro's silvery lustre in modern design. A few typical installations are shown here and many more have been made during the past year. Not only does Enduro meet every requirement of the designer but, for all bar and service equipment such as sinks, tanks, drainboards, counters and table tops, Enduro assures maximum sanitation and permanent resistance to tarnishing, corrosion and general wear.



Hotel Edison, New York, N. Y.
Designers—Eastman Decorators, Inc.
Enduro for bar work board and decoration about the fountain



McDoel's, Inc., Buffalo, N. Y.
Designer—M. J. Bernhard Co.
Enduro for back of bar, panels on front, wall panels and all bright metal

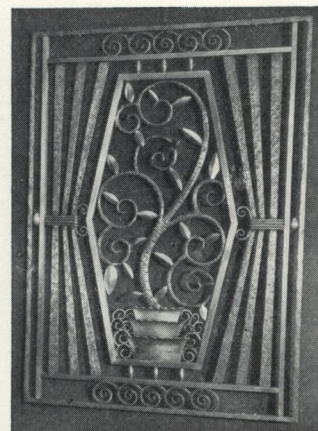
MISCELLANEOUS USES OF ENDURO



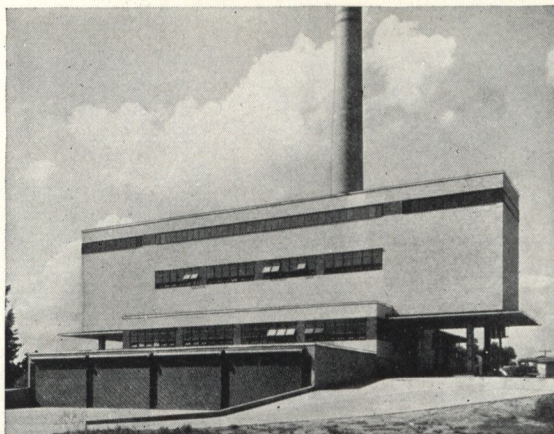
Hand Wrought Grille of Enduro Stainless Steel
Designer—Rose Iron Works, Inc.



Public Information Booth, Canton, Ohio.
Enduro for exterior walls, doors, sash and etched acknowledgment plate



Hand Wrought Grille of Enduro Stainless Steel
Designer—Rose Iron Works, Inc.



Municipal Incinerator, Shreveport, La.
Architects—Jones, Roessle, Olschiner and Weiner
Supervising Engineer—Marcus D. Weeks
Enduro for copings on walls of building



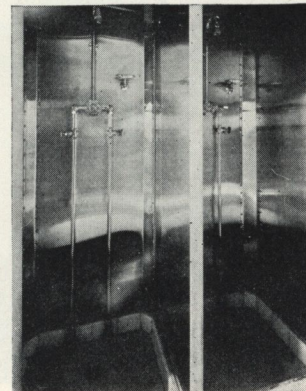
Photo: Harold Holiday Costain
Gifford Cochran Residence, North Salem, N. Y.
Architect—Albert Ely Ives
Enduro Stainless Sink, Drainboards and Counter Tops by Tracy Mig. Co. Steel Cabinets by Excel Metal Cabinet Co., Inc.



Wills Hospital, Philadelphia, Pa.
Architect—John T. Windrim
Enduro for drinking fountain



Bromley Theatre, Philadelphia, Pa.
Architects—Thalheimer & Weitz
Enduro for drinking fountain



U. S. Government Dredge "Savannah," Buffalo, N. Y. Enduro for lining of shower cabinets



A FEW FAMOUS BUILDINGS IN WHICH ENDURO HAS BEEN USED

Included are the Empire State Building, New York, N. Y.; Insurance Company of North America Building, New York, N. Y.; Southtown Theatre, Chicago, Ill.; Warner Bros. Theatre Building, Nashville, Tenn.; La Nacional Building, Mexico City, Mexico; Richman Bros. Store Building, Detroit, Mich., and the tower of the Chrysler Building, New York, N. Y.

TYPICAL METHODS OF INSTALLING ENDURO STAINLESS STEEL

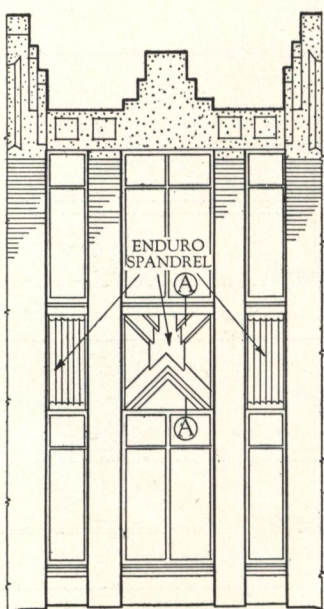
For nearly all of the more common applications of Enduro Stainless Steel the usual methods of detailing and installing any metal work will be found to be perfectly satisfactory. However, the remarkable properties and characteristics of Enduro make it suitable for use in locations heretofore impossible with metals subject to corrosion or which would not permanently retain the desired finish.

Such applications are receiving careful study to insure the most economical and satisfactory method of

installation, and unusual and time-saving details have been developed. Believing that the architect will be interested in studying some of the outstanding examples of such installations we have assembled data regarding the Enduro Stainless Steel used on a few recent buildings.

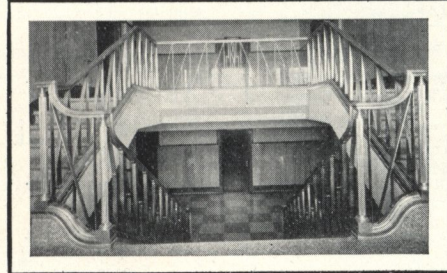
Republic Steel Corporation distributors and representatives will be glad to co-operate with the architect in developing methods to suit his particular problems.

McCOOK COUNTY COURT HOUSE, SALEM, S. D.




ENDURO SPANDREL

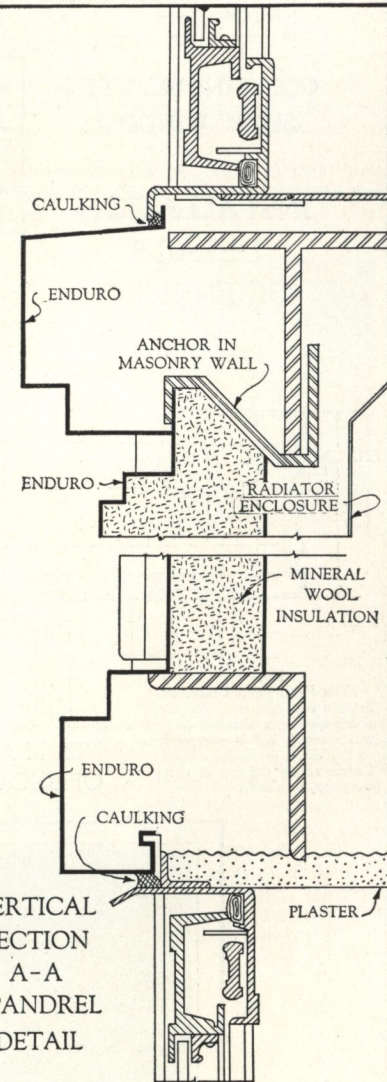
PART ELEVATION
SHOWING
ENDURO SPANDRELS



STAIR RAILINGS OF ENDURO
Mc COOK COUNTY COURT HOUSE SALEM, S. D.



Mc COOK COUNTY COURT HOUSE, SALEM, S. D.
Floyd F. Kings and Walter J. Dixon Architects
D. Floyd Rosser, Assoc. Architect



CAULKING

ENDURO

ANCHOR IN MASONRY WALL

ENDURO

RADIATOR ENCLOSURE

MINERAL WOOL INSULATION

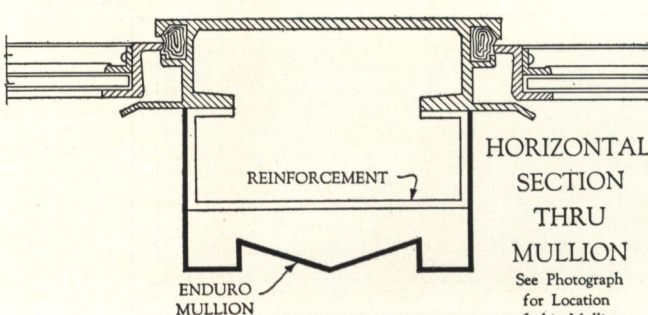
ENDURO

CAULKING

PLASTER

VERTICAL SECTION A-A SPANDREL DETAIL

SCALE OF DETAILS 3" = 1'



REINFORCEMENT

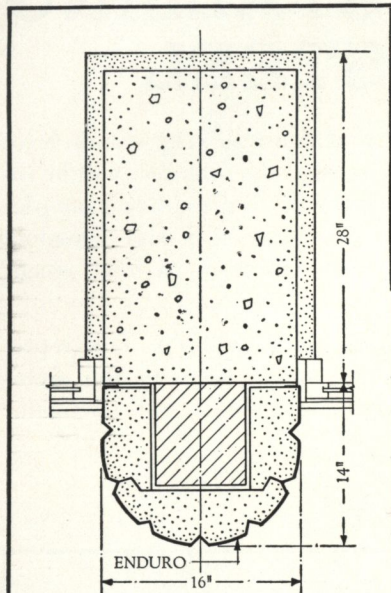
ENDURO MULLION

HORIZONTAL SECTION THRU MULLION
See Photograph for Location of this Mullion

INSTALLATION DETAILS OF ENDURO

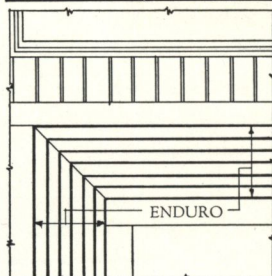
OFFICE AND DISPLAY BUILDING
CHRYSLER CORPORATION, DETROIT, MICH.
 Albert Kahn, Inc., Architects

The details below show the methods used for installing Enduro Stainless Steel in the new \$340,000 office and sales building of the De Soto Motor Corporation and the Chrysler Sales Corporation in Detroit. The building includes a model showroom with a complete front of plate glass and the interior is air conditioned. Enduro was used on the towers, as trim around the entrance doorways, across the top of the show windows and on the columns between the windows. Enduro was also used extensively on the Chrysler Building in New York.

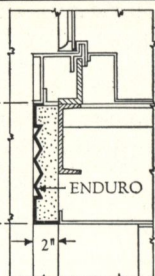


COLUMNS BETWEEN SHOW WINDOWS

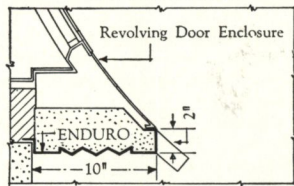
INSTALLATION DETAILS OF ENDURO



PART ELEVATION

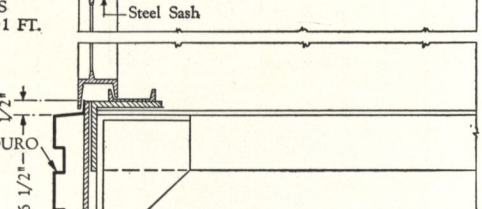
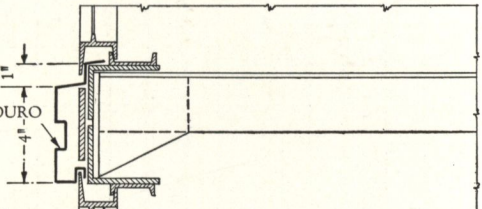
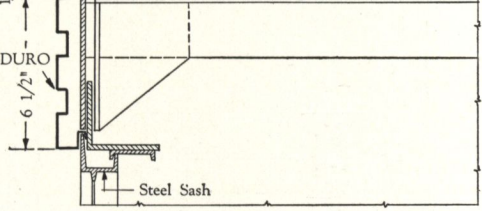
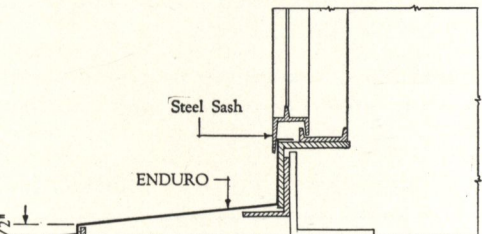
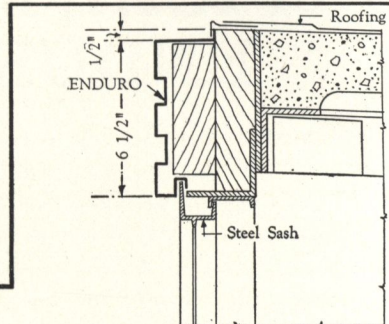


HEAD SECTION

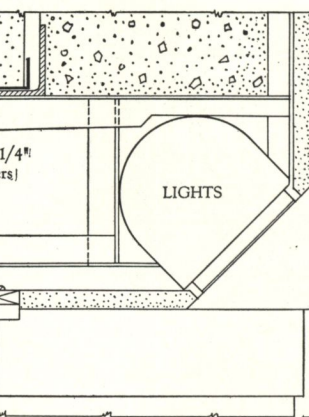


JAMB SECTION

TRIM AROUND MAIN ENTRANCE DOORWAYS

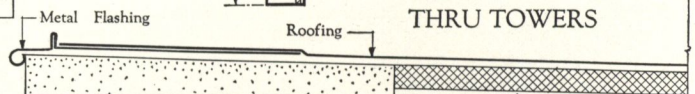


VERTICAL SECTION THRU TOWERS

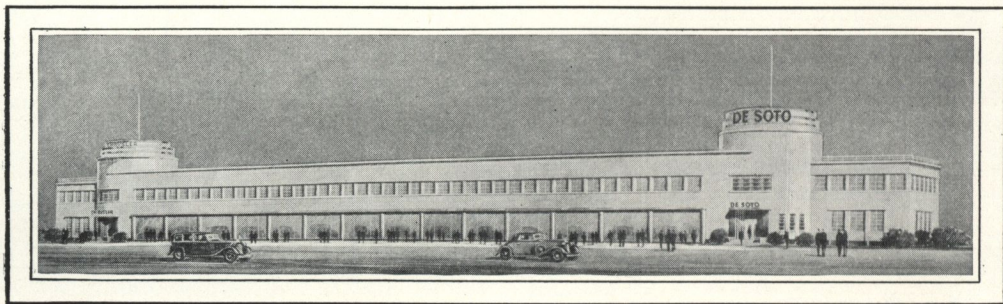


TRIM ACROSS TOP OF SHOW WINDOWS

SCALE OF DETAILS
 3/4" AND 1-1/2 IN.=1 FT.



Note
 The Head Band Course of Enduro over the two entrance doorways is not detailed on this sheet; it is, however, similar to the detail of Enduro Band Course across the top of show windows, as shown

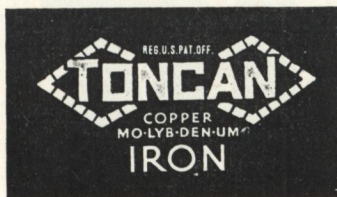


OFFICE AND DISPLAY BUILDING OF THE CHRYSLER CORPORATION
 Albert Kahn, Inc. DETROIT, MICHIGAN Architects

TONCAN IRON

THE MODERN FERROUS ALLOY FOR RUST-RESISTANCE AND CORROSION-RESISTANCE

As originated over 28 years ago, Toncan Iron was a highly refined iron, unalloyed with other elements but containing a minimum of rust-promoting impurities. Subsequent changes resulted from continuous research and relentless testing. Copper, in proper proportion, was alloyed with iron to form a new iron-copper alloy which was more resistant to rust than the original iron. Then followed the addition of molybdenum which produced an iron-copper-molybdenum alloy with a resistance to rust never before attained. Experience has demonstrated that neither copper nor molybdenum alone can contribute its full individual properties to the iron—



it is only through the addition of *both* in correct proportions that these can be realized. Such is Toncan Iron of today . . . an open hearth iron, scientifically refined to reasonable limits, in which not less than .40% copper and .07% molybdenum are uniformly dissolved . . . an alloy with a proved superior resistance to rust among the ferrous metals in its price class. Time and tests have conclusively proved that Toncan Iron brings to users of sheets (see page 19), plates (see page 20), finished products (see page 20), and pipe (see File Index), certain standing advantages which are briefly enumerated below.

How Toncan Iron Resists Rust and Corrosion

We have stated that, from the standpoint of resistance to rust and corrosion, Toncan Iron holds first place as a commercial ferrous sheet and pipe material.

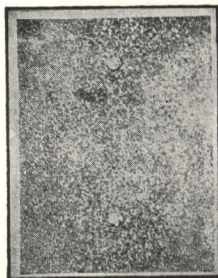
Tests in the laboratory and in actual service unquestionably bear out this statement.

Duplicate samples, 5x7 in., were cut adjacent to each other from galvanized sheets of each of the materials tested—Toncan

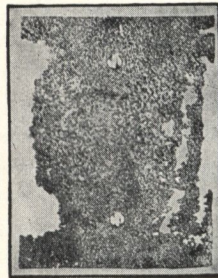
Iron, Copper Steel, Pure Iron and O. H. Steel (Low Copper).

These samples were placed side by side, insulated from each other, on a test fence for a period of six years. The results are shown below.

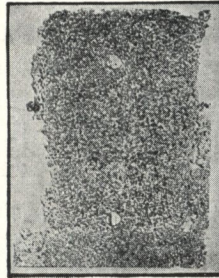
Authoritative, impartial testing associations, both in this country and abroad, have confirmed the results of his exposure test demonstrating clearly how Toncan Iron resists rust and corrosion.



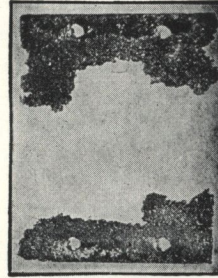
Toncan Iron



Copper Steel



Pure Iron



O.H. Steel

Samples After Having Been Placed Side by Side, Insulated from Each Other, on a Test Fence for a Period of Six Years

Physical Properties of Toncan Iron

The analysis and the chemical and structural uniformity of Toncan Iron assure satisfactory and dependable physical properties. Toncan Iron is unique in that it combines with its remarkable rust- and corrosion-resistance, physical properties not found in the best grades of open hearth steel. Many of these properties are due to the alloy addition of molybdenum. This element entirely dissolves without loss in the iron and thereby has a positive and beneficial effect. It produces a grain refinement which results in an improvement in strength and ductility, as well as greater rust-resistance. It increases the ability of the metal to withstand shock. It increases the susceptibility of the metal to heat treatment. It

increases the elastic ratio, that is, the ratio between elastic limit and tensile strength. These advantages are reflected in the following figures, showing a range for all Toncan Iron Products, arrived at after repeated tests: *Tensile strength*, 45,000–58,000 lbs. per sq. in. *Elastic limit*, 30,000–40,000 lbs. per sq. in. *Elongation in 2 in.* 30–40%. *Reduction of area*, 60–80%. *Rockwell hardness*, 36–46 (B scale). *Brinell hardness*, 90–120. *Specific gravity*, 7.88 approximately; about 2% greater than that of unalloyed iron or steel. *Electrical conductivity* about 12½% that of copper. *Thermal conductivity*, slightly better than steel or iron products. *Co-efficient of expansion*, .00000674 in. per degree F. melting point, 2775° F.

Physical Constants of Toncan Iron

Weight—283 lb./cubic inch.

Specific gravity—7.88 or approximately that of iron or steel.

Melting point—2775° Fahrenheit.

At room temperature (20° C. or 68° F.):

Electrical resistivity—eight times that of copper or approximately .0000137 ohm/cm. cube = 13.7 microhm/cm. cube = 77 ohm/circular mil foot.

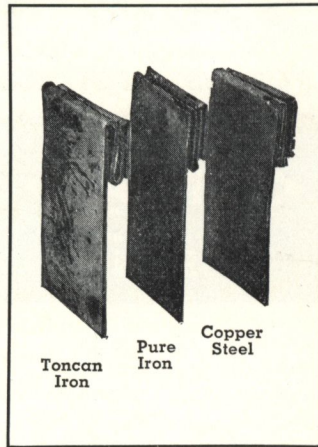
Electrical conductivity—12½% that of copper or approximately 73,000 reciprocal ohm/cm. cube = .013 ohm/circular mil foot.

Thermal conductivity—Slightly better than iron or steel or approximately .18 cal/cm. cube/sec/degree C = .7 watt/cm. cube/sec/degree C.

Linear co-efficient of thermal expansion—.0000121 cm./cm./degree C., 0–100° C. = .00000674 inch/inch/degree F., 32–212° F.

Toncan Iron Is Easy to Form

Toncan Iron is exceedingly ductile and can be formed into any commodity which is ordinarily made of sheet steel or iron. It is much softer than mild steel and, because of its workability, it can be deep drawn, formed, bent, flanged, stamped or spun. It is easy to cut or shear and requires less power and less labor for working. Toncan Iron can be annealed at a temperature of 1200° to 1250° F., to relieve strains caused by working and can be normalized at a temperature of 1700° F., followed by cooling in air to improve the grain structure of the iron after working. It can be welded, soldered, brazed, riveted, etc., and may be protected with various coatings or galvanized, galvannealed, sherardized, etc. The re-



markable rust-resistance of Toncan Iron extends uniformly throughout the entire thickness of the metal—not on the surface only—and it is the only commercial ferrous material with rust-resistance practically unaffected by cold-working or deformation. Other ferrous sheet materials ordinarily first dissolve and rust most rapidly at or adjacent to parts which have been cold-worked—such as seams, cut ends, bends and punched holes. The samples shown at the left were bent cold and, for four weeks, were immersed in a 20% solution of sulphuric acid at room temperature. The result demonstrates the ability of Toncan Iron to resist corrosive attack *after* fabrication as well as before.

Remarkable Welding Properties of Toncan Iron

The excellent welding properties and smooth-flowing behavior of Toncan Iron are valuable in that they make Toncan Iron the ideal metal for work where all joints are to be welded. Toncan Iron lends itself equally well to welding by either the electric arc or gas process. In gas welding, a slight reducing flame should be maintained in order to reduce oxidation to a minimum. In electric arc welding, the use of coated Toncan Iron Welding Rod is recommended. In gas welding, the deposited metal is practically as resistant

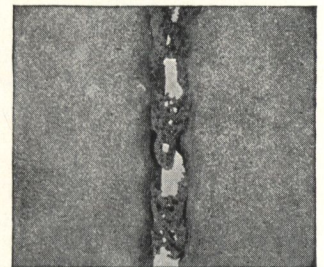
to corrosion as the metal itself. This is due to the fact that there is no change in the alloy during the welding operation, for the copper and molybdenum remain unaffected in their relation to the iron with which they are alloyed. Practically the same results can be obtained by the electric arc method, but the use of Toncan Iron electrodes is recommended. The use of Toncan Iron Welding Wire insures a completed job of uniformly high resistance to rust and corrosion throughout.



Illustrating the Ductility of Toncan Iron Arc Welds

Left:
Arc Weld Made with
Coated Toncan
Iron Wire
After testing in 20%
sulphuric acid for 10
hours. Weld in good
condition

Right:
Arc Weld Made with
Common Steel Wire
After testing in 20%
sulphuric acid for 6
hours. Weld failed



The Advantages of Toncan Iron

- (1) It resists, to a higher degree than any other ferrous material in its price class, the attacks of natural forces which cause corrosion.
- (2) Its high resistance to rust and corrosion is not confined to the surface or skin of the metal. Toncan Iron is uniformly resistant throughout its *entire cross-section*.
- (3) It combines with the high rust-resistance of an alloy iron, many desirable physical qualities not found in the highest grade open hearth steels.
- (4) It is one of the most ductile of materials. It is remarkably soft. It forms easily.
- (5) Unlike other ferrous materials, cold working—cutting,

- bending, punching, stamping, drawing, etc., has practically no effect upon rust-resistance of Toncan Iron.
- (6) It welds easily by any of the usually accepted modern methods. The use of Toncan Iron Welding Rod insures an installation of equal rust-resistance throughout.
- (7) A uniform and tightly adherent galvanized coating can be applied, thus adding the protection of a coating of zinc to the already high rust-resistance of the base metal itself.
- (8) Through its longer service-life, it has been found to cost far less per year of service. Its use is more than an economy. It is greater insurance against sheet and pipe failures and frequent costly replacements.

● T O N C A N I R O N S H E E T S

TYPES AND FINISHES OF TONCAN IRON SHEETS

Below are given, in brief, the various types and finishes in which Toncan Iron Sheets are available. Any assistance desired in the selection of the proper material for any specific use will be given gladly upon request to the nearest District Sales Office listed on the back cover of this catalogue.

● **TONCAN IRON GALVANIZED**

These are rust-resisting Toncan Iron Sheets, with the added protection of a heavy coating of pure zinc, hot dipped. They are available in gauges 8 to 28 inclusive.

● **TONCAN IRON HOT ROLLED, ANNEALED**

These sheets are those which were formerly referred to as One Pass Cold Rolled and Box Annealed Toncan Iron Sheets. They are made in gauges 17 to 26 inclusive.

● **TONCAN IRON HEAVY HOT ROLLED, ANNEALED**

These heavy hot rolled, annealed, Toncan Iron Sheets are the successors to the formerly well-known Toncan Iron Blue Annealed Sheets. They are made in gauges 9 to 16 inclusive.

● **TONCAN IRON ENAMELING SHEETS**

These popular Toncan Iron Sheets are made with a specially prepared surface designed to grip the vitreous enamel coat—a superior sheet for all enameling purposes. They are made in gauges 9 to 24 inclusive. *Note:* Toncan Iron is also now available in Tin Mill gauges and sizes. May be had as light as 30 gauge Tin Mill Rolling only.

● **TONCAN IRON HEAVY COLD ROLLED**

Here is a heavy cold rolled sheet free from scale and surface defects and which is especially popular where a smooth and rust-resisting product is desired. Made in gauges 9 to 16 inclusive.

● **TONCAN IRON COLD ROLLED**

This Toncan Iron Sheet is used largely in partitions, automobile construction and in all places where the need for a smooth, glossy surface and for rust-resistance demands a better product. These sheets are made in gauges 17 to 24 inclusive.

● **TONCAN IRON GALVANNEALED**

Toncan Iron Galvannealed Sheets are made by a patented process whereby the galvanized coating becomes impregnated into the base iron, making it impossible to peel or flake under the most difficult forming operations. They are made in gauges 14 to 28 inclusive.

● **TONCAN IRON OVEN LINING GALVANNEALED**

These Toncan Iron Sheets are made by a patented process specially designed to meet the exacting requirements of an oven lining where there has been so much trouble in peeling, rusting, etc. Used by many of the world's largest stove manufacturers, Toncan Iron Oven Lining Galvannealed is made in gauges 24 to 26 inclusive.

● **TONCAN IRON TERNE COATED**

This very popular Republic product is a lead and tin coated Toncan Iron Sheet applicable to all uses where such coating is preferred. It is especially useful where difficult forming operations are used and is made in gauges 14 to 26 inclusive.

MAXIMUM SIZES OF SHEETS

This table indicates the rolling limits of Toncan Iron Sheets in hot rolled, annealed, galvanized, heavy hot rolled annealed and special finishes—with the exception that hot rolled, annealed Toncan Iron Sheets are not made lighter than 26-gauge, while galvanized sheets are not supplied in greater length than 144 in.

Width, Inches	50	48	46	44	42	40	38	36	34	32	30	28	26	24
Gauge	Length in inches													
No. 7 and 8	120	120	120	120	120	120	120	120	120	120	120	120	120	120
No. 9 and 10	168	168	168	168	168	168	156	156	156	156	144	144	144	130
No. 11 and 12	168	168	168	168	168	168	168	168	168	168	144	144	144	130
No. 13 and 14	156	156	156	156	156	156	156	156	144	144	144	144	144	130
No. 15 and 16	144	144	144	144	144	144	156	156	144	144	144	144	144	130
No. 17 and 18							120	144	144	144	144	144	120	120
No. 19, 20, 21, 22, 23, 24							144	144	144	144	144	144	144	144
No. 25, 26, 27							120	144	144	144	144	144	144	144
No. 28								144	144	144	144	144	144	144

REPUBLIC STEEL CORPORATION

TONCAN IRON PLATES

In Toncan Iron Plates, REPUBLIC STEEL CORPORATION makes available a worthy "big brother" to Toncan Iron Sheets. Made of Toncan Copper Molybdenum Iron—with all of its remarkable rust- and corrosion-resisting qualities and greater ductility—Toncan Iron Plates meet an insistent demand from those industries requiring heavy rust-resisting plates. Railroads through-

out the nation, for instance, are turning to Toncan Iron Plates. They are also being widely used for stacks, boilers, tanks in shipbuilding—in fact wherever a heavy iron plate that insures long trouble-free service is desired. Toncan Iron Plates are made in a large range of gauges and sizes as shown in the following table:

Thickness	Widths and lengths, inches															Diameter of circles, inches									
	24	36	42	48	54	60	66	72	78	84	90	96	102	108	114		120	126	132	138	144	150			
No. 10 BWG...	320	300	340	320	300	300	290	290	...	...	...	...	...	...	...	...	...	...	...	...	...	...	72
No. 8 BWG...	480	300	480	480	400	380	350	300	300	220	...	...	...	...	...	...	...	...	...	...	...	...	84
1 1/8"	480	480	480	480	480	480	480	480	480	480	460	400	280	240	240	200	...	...	...	...	...	...	120
1 1/4"	480	480	480	480	480	490	490	490	480	480	480	480	380	360	360	300	275	240	220	220	...	...	144
1 1/2"	480	480	450	490	490	500	490	490	460	430	430	400	360	360	320	300	280	250	240	240	...	...	150
1 3/4"	410	450	510	550	580	580	580	550	520	500	480	440	400	380	360	350	330	310	300	270	210	...	152		
1 7/8"	410	460	550	620	640	640	640	600	600	600	500	450	450	430	400	400	380	360	340	320	240	...	152		
2"	410	460	580	630	640	640	640	640	640	640	640	540	540	520	520	480	460	440	420	400	240	...	152		
2 1/8"	410	460	580	640	640	640	640	640	640	640	640	540	540	540	520	480	480	440	420	380	240	...	152		
2 1/4"	410	460	580	640	640	640	640	640	640	640	640	550	540	540	520	480	450	420	400	370	240	...	152		
2 1/2"	410	460	580	640	640	640	640	640	640	640	640	600	600	600	540	520	480	450	420	400	370	230	...	152	
2 3/4"	410	460	580	640	640	640	640	640	640	640	640	600	600	600	540	520	480	450	420	400	370	230	...	152	
3"	410	460	580	640	640	640	640	640	640	640	640	600	600	600	550	550	510	460	450	420	400	370	210	...	152
3 1/8"	410	450	580	610	580	550	550	550	550	550	550	550	550	520	500	480	430	400	370	350	330	210	...	152	
3 1/4"	410	450	540	520	520	520	520	520	520	510	500	500	500	500	480	430	400	370	350	330	200	...	152		
3 1/2"	200	350	470	480	520	520	520	520	520	490	480	480	480	480	460	420	390	360	340	320	190	...	150		
3 3/4"	200	200	450	460	500	500	500	460	430	470	440	440	440	440	420	390	360	340	320	190	...	150			
4"	200	200	430	440	480	480	460	420	400	450	380	360	420	420	410	400	360	360	330	300	...	144			
4 1/2"	200	200	400	400	400	370	350	350	360	360	340	320	400	390	370	350	330	320	310	300	...	144			

Note: If widths and lengths other than those above are required, tell us your requirements—special sizes are made to specifications.

TONCAN IRON FINISHED PRODUCTS

Corrugated Sheets

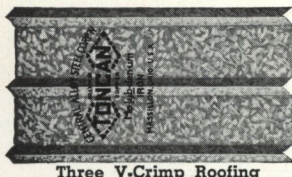
Corrugated sheets are light in weight and have great lineal rigidity. They add strength and allow a considerable saving in sheathing and other supporting materials necessary with weaker or heavier materials. These advantages, with the fire protection offered by corrugated sheets, account for their almost universal use in roofing and siding for industrial buildings, warehouses, mine buildings, etc. Corrugated sheets are also ideal for barns, garages, sheds and a wide variety of other buildings.

Corrugated sheets are standard in 2 1/2 in. and 1 1/4 in. corrugations. In the 2 1/2 in. sheets the corrugations are 2 3/8 in. center to center and 1/2 in. deep. All gauges No. 10 and lighter. Widths: Siding—26 in.; Roofing—27 1/2 in. Lengths: 5, 6, 7, 8, 9, 10, 11 and 12 ft. In the 1 1/4 in. sheets the corrugations are 1 1/2 in. center to center and 3/8 in. deep. Gauges No. 20 and lighter. Width, 26 in. Lengths: 5, 6, 7, 8, 9, 10, 11 and 12 ft. Can be furnished curved at one or both ends to specifications, cross-corrugated, or cross-cripped for cornice and similar work.

V-Crimped Roofing

V-Crimped is the oldest form of iron roofing and has been used extensively. Construction is simple and makes a good appearance at reasonable cost. Can be applied over close sheathing, to strips spaced four or five inches apart or over old shingles (in the latter case a 3-in. nail should be used). The three V-crimped makes a stiffer sheet, while five V-crimped is still stronger.

All three styles are supplied in lengths of 5, 6, 7, 8, 9, 10, 11 and 12 ft., and in gauges 20 and lighter. Actual covering width of each style is 24 in. With this type of roof V-shaped wood strips are necessary. These are supplied when ordered.



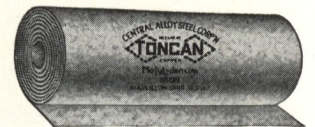
Three V-Crimp Roofing

Standing Seam Roofing

This type of roofing is strong and attractive in appearance. It can be applied over shingles, over close sheathing or to strips. No nails are driven through the roofing sheets, but this type of roof properly applied has perfectly water-tight joints. Pressed Standing Seam Roofing is supplied in sheets 5, 6, 7, 8, 9, 10 or 12 ft. long, in 28 and 27 gauges galvanized and in gauges 26, 24, 22 and 20 either painted or galvanized. Covering width in all cases 24 in.

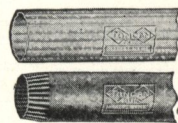
Roll Roofing

This is an excellent form of roofing and is often preferred for large areas and where pitch is slight. Cross seams are double locked and notched, and end lock is protected by V wood strip. Each roll is 50 ft. long and perfectly straight, sides and ends of each sheet having been resquared before galvanizing. The sheets are full width to give a covering width of 24 in. or 100 sq. ft. to the roll.



Roll Roofing

Ridge Roll, Eaves Trough, Wall Flashing



Toncan Iron Conductor Pipe

Round corrugated, square corrugated and plain round conductor pipe. Lengths, 8 and 10 ft. All diameters. Elbows, miters and cut-offs to match.



Toncan Iron Eaves Trough

Lengths, 10 ft. All widths: 28 and gauges Nos. 28, 26 and 24



Corrugated End Wall Flashing

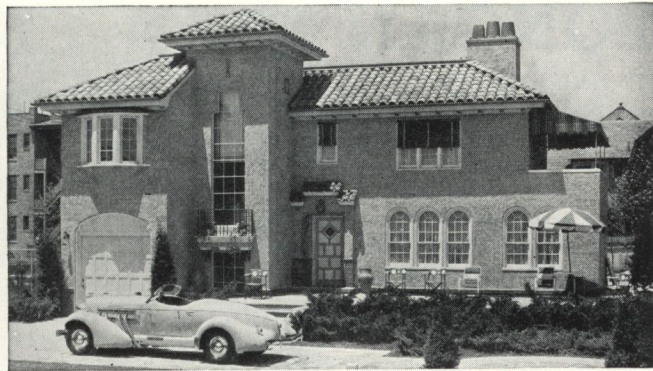
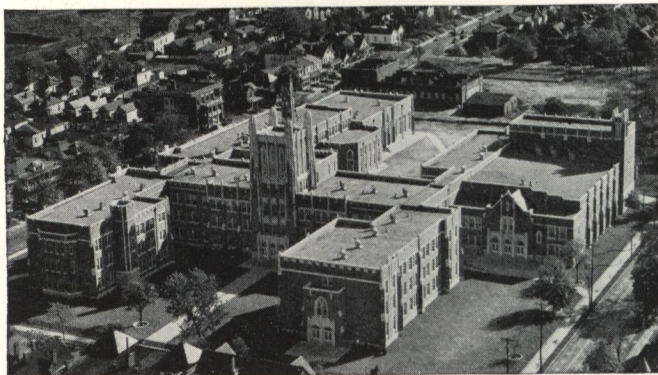
Flat side on wall, 2 in. Corrugated apron, 4 in. Lengths, 27 and 96 in.



Corrugated Ridge Roll

2 1/2 or 1 1/4-in. corrugations. Lengths, 27 and 96 in.

● TONCAN IRON SHEETS



Louisville Girls' High School, Louisville, Ky.
Architect—J. Meyrick Colly, School Board Architect
All Senior and Junior Cafeteria equipment of Enduro Stainless Steel. All water and steam connections of black and galvanized Toncan Pipe

Model Home of America, Atlantic City, N. J.
Supervising Architects—Rosenstein & Puron
Toncan Iron Sheets used for ducts of air conditioning system

ARCHITECTURAL USES OF FABRICATED TONCAN IRON

Why Architects and Engineers Specify Toncan Iron

After devoting months, even years, to the creation and design of a beautiful building, the architect has just cause to take pride in his work and to seek means of endowing it with permanence. He wishes to give full measure in quality to the client who has entrusted him with specifying those materials which best meet service requirements. Toncan Iron brings to the building industry the highest degree of resistance to rust and corrosive action obtainable among ferrous metals in its price class. It also insures economy of installation through its unsurpassed ductility and working qualities.

Because of its versatility, Toncan Iron has met with broad usage from engineers and has proved itself in countless installations under severe service conditions. Structural engineers prefer Toncan Iron for roofing, siding, partitions, pipe and many other applications too numerous to mention. Heating and ventilating engineers specify Toncan Iron for all sheet metal work in heating, ventilating and air conditioning installations.

The truth of every claim made for Toncan Iron as to its durability, economy and other superior merits has been confirmed by the verdict of the leading architects and engineers.

Typical Uses of Toncan Iron

Air conditioners
Airplane hangars
Awning covers
Balustrades
Bathroom cabinets
Belt guards
Blower ducts
Boiler breechings
Boiler jackets
Bolts
Bridge arches
Brine tanks
Bulletin boards
Cabinet heaters
Cabinets
Canopies
Catch basins
Chimney tops

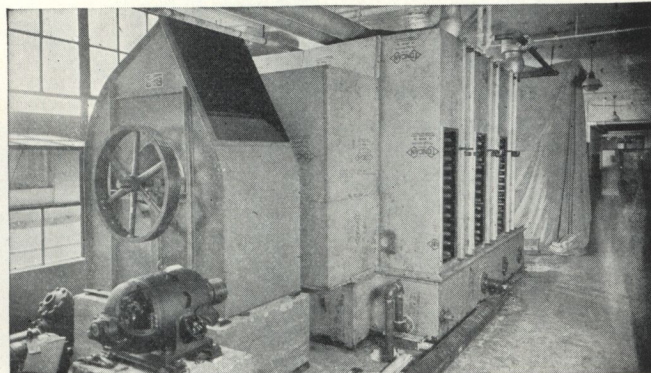
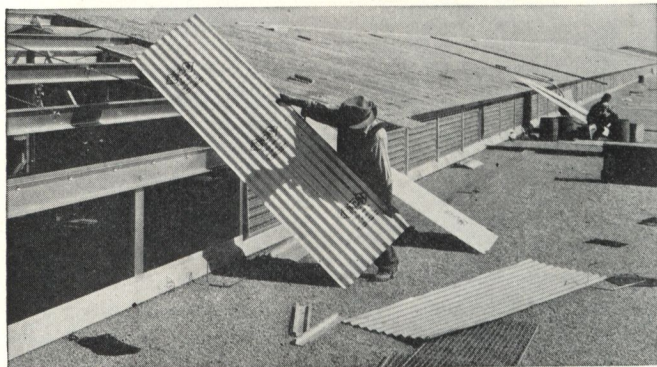
Cistern filters
Clothes chutes
Clothes dryers
Coal chutes
Coils for steam and hot water lines
Concrete forms
Condensation pans
Conductor pipe
Conduits
Coping
Cornices
Dampers
Dishwashers
Doors (exterior)
Downspouts
Drainboards
Drinking fountains

Dryers
Ducts, heating, ventilating and air conditioning
Dust collectors
Eaves trough
Electric heaters
Electrical terminal boxes
Expansion tanks
Fan housing
Fire doors
Flashing
Forged iron lanterns
Furnaces and pipes
Gas radiators
Gas and oil pipe
Gutters
Hospital equipment

Hotel and restaurant equipment
Humidifying pans
Incinerators
Kitchen cabinets
Laboratory equipment
Laundry tubs
Lighting fixtures
Lockers for bathing
Louvers
Mail boxes
Marques
Metal ceilings
Metal doors
Metal partitions
Metal trim
Pilasters
Pipe

Playground equipment
Porcelain table tops
Radiator shields
Range boilers
Ranges (coal, gas, electric, oil and gasoline)
Reflectors
Refrigerators
Registers
Roofing
Roof flashings and valleys
Rubbish burners
Septic tanks
Shingles (metal)
Siding
Signs
Sinks

Skylights
Smoke stacks
Stand pipe
Switch boxes and covers
Tile (porcelain enameled)
Tubing
Underground garbage holders
Urns
Vats
Wall boxes
Waste paper boxes
Water tanks
Window boxes
Window frames
Window sash
Window ventilators
Wire fence



Walnut Storage Warehouse, Huntington Park, Cal.
Architect—Albert C. Martin

United Drug Company, St. Louis, Mo.
Engineer—R. H. Tait & Sons Corp.

Toncan Iron Corrugated Sheets for roofing. Toncan Iron Flat Sheets for skylights, flashing and gutters. Toncan Pipe for plumbing

Toncan Iron Pipe and Sheets for ammonia evaporator in air washer of air conditioning system

TONCAN IRON ENAMELING STOCK

Porcelain enamel offers the architect a permanent, flexible medium, almost unhampered as far as range of colors or workability goes. He need not use it to imitate some other medium. Rather he may follow the modern trend to the frank use of materials in their own form—steel as steel, wood as wood, concrete as concrete, porcelain enamel as porcelain enamel.



Some Places Where Enameled Iron May Be Used to Advantage

Spandrels	Decorative Panels	Marquees and Canopies
Mullions and	Post Housings	Range and Laboratory
Pilasters	Panelling	Hoods
Mural Ornaments	Signs	Hospital Cabinets
Side Walls, exterior	Store Fronts	Mouldings
Side Walls, interior	Counters	Refrigerators
and ceiling	Display Cases	Sinks

Although only recently have the decorative as well as practical possibilities of enameled iron engaged the attention of architects, it is interesting to note that Toncan Iron has been used for years as the base metal for all types of vitreous enameled products.

Toncan Iron Enameling Sheets have been and are being used for forming all kinds of manufactured products such as washing machine tubs, gas and electric stove parts, sinks, drainboards, shelving, signs and many others which are later enameled. Toncan Iron has proved completely satisfactory as a base for such products which are usually subjected to far more severe service than will be most of the enameled products used in architectural applications.

Its use for architectural purposes has increased at the same rate as has the development of easily fabricated and enameled sheets, and the development of durable enamels.

The architect need not fear the impossibility of rendering a structural creation in porcelain enamel since Toncan Iron Enameling Sheets are custom made to insure easy fabrication into any form or shape which he may conceive. Because of their absolute flatness and uniform freedom from waves, Toncan Iron Enameling Sheets are ideal for flat surfaces, such as panels, counters, walls, signs, etc.

In no other permanent medium is the architect able to make such lavish or unrestricted use of color. Modern frits produce long-lasting, color-fast, non-corroding, and (when so specified) acid-resisting porcelain enamels. Modern base metals such as Toncan Iron Enameling Sheets, provide a workable, easily formed base for these enamels.

Applications of Porcelain Enameled Iron in Building Construction

The modern store, restaurant, filling station, office building and home is undergoing a rebirth in design. Mercantile establishments are dropping sombre colors and utilizing colorful store fronts and interiors to attract customers. Restaurants realize that a clean, sanitary appearance is as important as good food and service. Gasoline filling stations must depend upon their appearance to attract passing motorists. Office buildings are making use of materials which reduce the cost of cleaning and maintenance. Homes need inexpensive materials which are durable and beautiful.

To all of these porcelain enamel is a medium which fulfills all reasonable requirements of economy, beauty, flexibility and permanence.

Advantages of Porcelain Enameled Iron in Architectural Applications

- **Permanent Beauty**—The color range is unlimited. Practically any painting or design can be faithfully reproduced in all the original colors for decorative wall panels. Single sheets are made in sizes up to four by six feet, but when larger panels are required it is entirely practical to spread the design over two or more sheets which are later mounted together.
- The metal being permanently and completely covered by the enamel cannot rust or corrode and is practically everlasting.
- **Economical Upkeep**—Porcelain enamel is absolutely permanent. Colors never fade even when exposed to the most severe conditions. There is no repainting as is the case with wood.
- **Simple and Easy to Clean**—Dust and grease do not adhere to the hard smooth surface so that cleaning is required but seldom. When it is necessary, simple washing with soap and water will restore the original beauty. No sand blasting or steam cleaning is required as with masonry.
- **Ease of Fabrication**—Porcelain enamel may be formed into practically any desired form. Fluted columns, embossed designs, formed mouldings, perforated grilles, crimped shapes are all readily formed with Toncan Iron Enameling Sheets.
- **Mat or Glazed Finish**—While the highly glazed finish is most common, porcelain enamel may be produced with a dull or mat finish which eliminates all glare. This finish is especially desirable in many exterior building applications.
- **Economical to Use**—Modern production methods, by reducing costs, make it feasible to use porcelain enamel in small modest buildings as well as in more elaborate structures.
- **Readily Available**—Competent enamellers are found in all larger cities. They will gladly consult with architects as to their requirements. Any Republic District office will furnish the names of concerns in your vicinity who will faithfully reproduce your designs.



Kinsel Drug Store, Detroit, Mich.
Architects—Pollmar, Ropes & Lundy
Enduro used for edging on Glasiron Macotta

Toncan Iron Enameling Sheets Meet the Modern Need

To meet the requirements of the modern applications of porcelain enamel as described above requires a high grade sheet.

The physical properties of the sheet are, of course, of an importance equal to its ability to accept a satisfactory coat of porcelain enamel, and the wide spread use of enameled products has involved some of the most difficult fabrication operations which are encountered anywhere in the use of sheet metal.

● TONCAN IRON ENAMELING STOCK

Experience of many years has demonstrated that open hearth irons are most suitable for porcelain enameling. Toncan Iron is one of the oldest open hearth irons in the market, having been produced for more than twenty-eight years.

Toncan Iron Enameling Sheets, therefore, combine the physical properties required for difficult fabrication and the ability to accept a high grade coat of porcelain enamel.

Toncan Iron Sheets, before and after enameling are unusually flat, free from waves and buckles and in addition have the highly desirable properties of an open hearth iron for enamel adherence and freedom from segregated impurities which might react with the porcelain enamel.

Constant research is conducted by Republic in an effort to keep Toncan Iron at all times suitable for all types of porcelain enamel. Close cooperation with the manufacturers of frits, as well as with those plants which produce their own frit, is in effect that we may work out with the enameler any problem in connection with the use of our product.

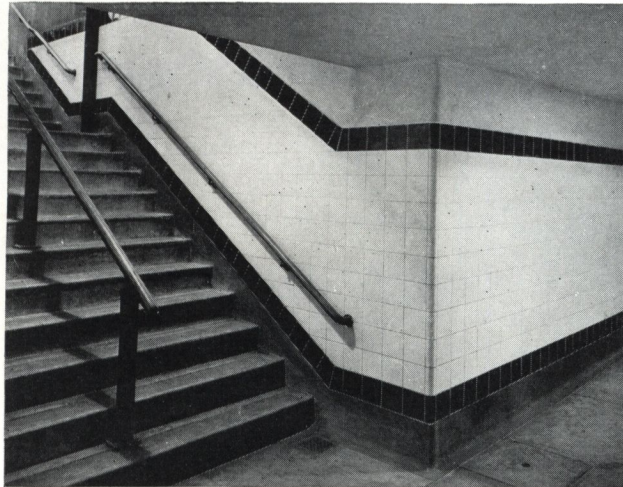
Erection and Forms of Porcelain Enameled Iron

In the application of porcelain enameled iron in the construction industry many novel methods and forms have been developed.

Sheets either plain or embossed may be applied by screws, bolts or nails to furring strips or other base. Several styles of clips have been developed to meet special conditions.

Mouldings drawn or rolled into any desired form are applied in a similar manner. Used in combination with sheets they cover the joints and screw heads.

Fluted sheets or columns are used for decoration and are usually applied by clips.



Haymarket Square Pedestrian Tunnel, Boston, Mass.
Designer—Boston Transit Co.

Toncan Iron Enameling Stock used for black and white porcelain enameled steel tile

"Glasiron Macotta" is a porcelain enameled shell with a backing of Haydite concrete. It is applied the same as masonry, or with tie clips as is brick veneer.

Enduro Stainless Steel may be used to advantage as a trim in combination with porcelain enameled iron, providing permanence and beauty.

Designing With Porcelain Enameled Iron

The architect will appreciate the many possibilities for unique and beautiful designs which are now offered by porcelain enameled iron. As has been mentioned previously the range of colors is practically unlimited

and, especially in the modernization of store fronts and restaurants, color is becoming increasingly important. With the use of porcelain enameled iron the design of the front may be attractively and effectively harmonized with the design of the signs as well as with the color and design of the interior.

By the use of fluted columns in color the effect of height may be obtained or mass may be emphasized. The design and the lighting of the front, the window and the interior may now be considered and treated as one problem and, by combining Enduro Stainless Steel and colored porcelain enameled iron unusually rich and individual results may be secured. For interior design porcelain enameled iron permits the architect to use color for wall decorations, counters, display cases and many other applications heretofore impractical because of material limitations.

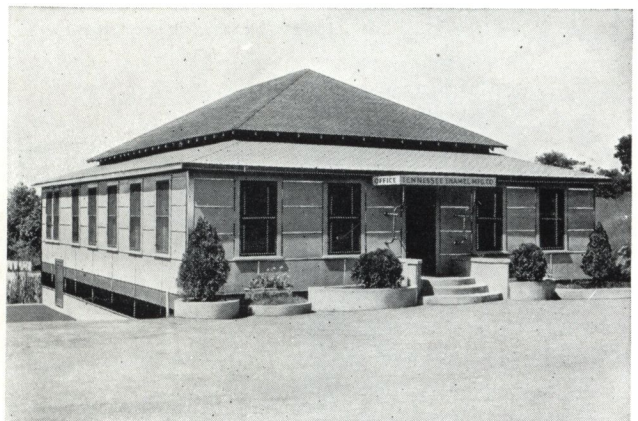
Complete Engineering Service Available

REPUBLIC STEEL CORPORATION maintains a special engineering department devoted to the development and application of enameled iron. Republic specialists are always glad to assist architects in working out the best methods of producing their designs and applying them to the finished buildings.



Browning, King and Co., Brooklyn, N. Y.

Entire building sheathed with cream and mauve Toncan Iron Enameling Stock. The lettering on the building front is formed from mauve Toncan and the same is used to frame the store windows and entrances



Tennessee Enamel Mfg. Co., Nashville, Tenn.

The exterior is of green porcelain enamel panels on Toncan Iron Enameling Stock with Enduro Stainless Steel trim on joints which gives a highly decorative effect and insures maximum corrosion resistance

Republic Steel CORPORATION

GENERAL OFFICES . . . CLEVELAND, OHIO
CENTRAL ALLOY DIVISION . . . MASSILLON, OHIO

DISTRICT SALES OFFICES

BIRMINGHAM, ALA., Empire Bldg.
BOSTON, MASS., 250 Stuart St.
BUFFALO, N. Y., Liberty Bank Bldg.
CHICAGO, ILL., McCormick Bldg.
CINCINNATI, OHIO, Carew Tower
CLEVELAND, OHIO, Republic Bldg.
DENVER, COLO., Continental Oil Bldg.
DETROIT, MICH., Fisher Bldg.
GRAND RAPIDS, MICH., Grand Rapids Trust Bldg.
HOUSTON, TEXAS, Gulf Bldg.
INDIANAPOLIS, IND., Circle Tower
KANSAS CITY, MO., Dwight Bldg.
LOS ANGELES, CALIF., Edison Bldg.

MILWAUKEE, WIS., First Wisconsin National Bank Bldg.
NEW YORK CITY, Chrysler Bldg.
PHILADELPHIA, PA., Broad Street Station Bldg.
PITTSBURGH, PA., Oliver Bldg.
ST. LOUIS, MO., Paul Brown Bldg.
SALT LAKE CITY, UTAH, Atlas Bldg.
ST. PAUL, MINN., First National Bank Bldg.

EXPORT DEPARTMENT, Chr
Warehouse Stocks of Enduro St
Molybdenum Iron are carried in
tribution contact the near
Enduro Licensed under Chemical Founda



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Robert Vail Cole Jr, AIA
1962 - 2011

Republic Steel

C O R P O R A T I O N

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CENTRAL ALLOY DIVISION . . . MASSILLON, OHIO

DISTRICT SALES OFFICES

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BUFFALO, N. Y., Liberty Bank Bldg.	PHILADELPHIA, PA., Broad Street Station Bldg.
CHICAGO, ILL., McCormick Bldg.	PITTSBURGH, PA., Oliver Bldg.
CINCINNATI, OHIO, Carew Tower	ST. LOUIS, MO., Paul Brown Bldg.
CLEVELAND, OHIO, Republic Bldg.	SALT LAKE CITY, UTAH, Atlas Bldg.
DENVER, COLO., Continental Oil Bldg.	ST. PAUL, MINN., First National Bank Bldg.
DETROIT, MICH., Fisher Bldg.	SAN FRANCISCO, CALIF., Rialto Bldg.
GRAND RAPIDS, MICH., Grand Rapids Trust Bldg.	SEATTLE, WASH., White-Henry-Stuart Bldg.
HOUSTON, TEXAS, Gulf Bldg.	TOLEDO, OHIO, Ohio Bank Bldg.
INDIANAPOLIS, IND., Circle Tower	TULSA, OKLA., Thompson Bldg.
KANSAS CITY, MO., Dwight Bldg.	WASHINGTON, D. C., Shoreham Bldg.
LOS ANGELES, CALIF., Edison Bldg.	YOUNGSTOWN, OHIO, Republic Bldg.

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