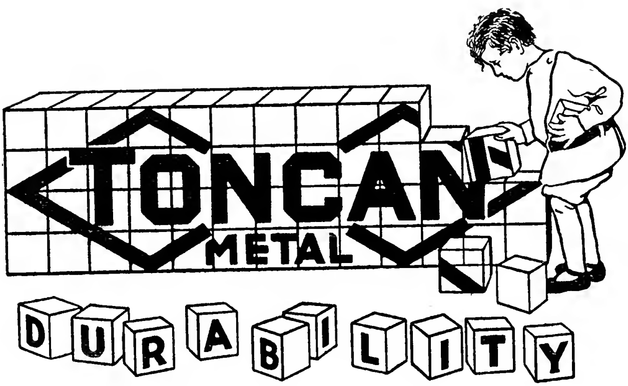
SHEET METAL PRIMER

SHEET METAL PRIMER



REVISED EDITION

THE STARK ROLLING MILL CO.
Canton, Ohio

Form 897A—10-20—25M

LESSON I

IRON ORE

IRON ORE is a reddish-brown mineral, found in both a granular and rock-like form.

It is very seldom found pure. Usually it is full of earthy matter and very impure.

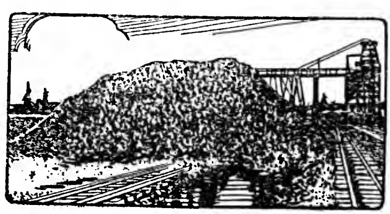
The most common impurities and the most harmful to the finished material, when present in excess, are Carbon, Sulphur, Phosphorous, Manganese and Silicon.

The largest iron ore deposits in this country are in the Lake Superior district.

In the Lake Superior district the ore lies near the surface of the earth and can be cheaply mined with large steam shovels.

In less favored districts shafts must be sunk and the ore mined and brought to the surface by elevators.

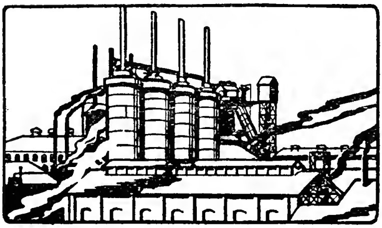
The ore is loaded into large boats which take it to the great blast furnaces.



IRON ORE READY TO BE SHIPPED

LESSON II

THE BLAST FURNACE



A BLAST FURNACE

WHAT is a Blast Furnace?

A Blast Furnace is a huge cylindrical steel shell, lined throughout with fire brick and varying in height from forty to one hundred feet, or even higher.

It is used to separate iron ore from earthy matter and part of the impurities.

The Blast Furnace eliminates only a very small part of the impurities, as the Blast Furnace process is really the first step in making a useful material from the iron ore. The metal is further refined by other processes.

Each Blast Furnace is connected with four stoves. These stoves are huge cylindrical tanks of steel about as high as the Blast Furnace itself.

After the fire brick linings in the stoves are heated to a high temperature air is blown into them to be heated.

When this air is intensely hot it is blown, by immense engines, into the blast furnace which is filled to the top with alternate layers of iron ore, limestone and coke.

Thus, the iron ore is reduced first to a spongy mass, and then to a liquid state.

It is the duty of the limestone to combine with the earthy matter and impurities and leave the molten iron free.

The limestone and earthy matter is called "slag." The slag rises to the top and is run off.

The molten iron is released from the Blast Furnace by drilling through the tap hole with a heavy pointed steel bar.

From one hundred to one hundred and fifty tons of liquid iron flow through this tap hole, carrying with it about twenty-five or thirty tons of slag which could not be removed from the top.

This slag is removed from the iron by a "skimmer," which is an iron plate extending down almost to the bottom of the trough. The molten iron flows under the "skimmer" and the lighter slag is diverted into another runner.

The iron is cast in molds and the product called Pig Iron.

TOP OF BLAST FURNACE
SHOWING METHOD OF FILLING

LESSON III

PIG IRON

WHAT is Pig Iron?

Pig Iron is the reduced iron produced by the Blast Furnace.

As the molten iron comes from the Blast Furnace it is run into molds or distributed into brick lined ladles mounted on wheels and sent on to the next refining process—the Open Hearth Furnace or the Bessemer Convertor.

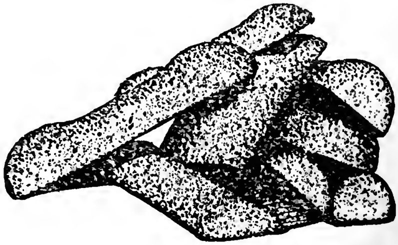
The advantage of casting the iron into molds, or "pigs" is that it can be stored away for future use.

Two methods are used for casting Pig Iron—one is by machine and the other is by casting in sand.

The method of casting pigs by machine is a great improvement over sand casting. It is not so hot for the workmen and it produces pigs which are cleaner and free from sand.

Many blast furnaces still use the sand-casting method.

Pig Iron is really a raw material and cannot be rolled directly into sheets without further refinement.



PIG IRON

LESSON IV

THE BESSEMER PROCESS

THE Bessemer Process for making Steel is named after one of its inventors, Sir Henry Bessemer. The Steel is called Bessemer Steel.

Bessemer Steel is made in a convertor.

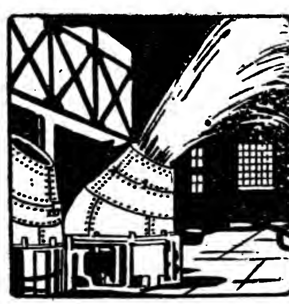
A convertor is a pear shaped retort with a large number of holes in the bottom.

The molten pig iron is poured into the convertor and a powerful blast of air is blown through the holes in the bottom.

This air enters and passes through the molten metal, literally burning out the impurities. The gaseous impurities go out of the mouth of the convertor in the shape of sparks and flames, while the solid impurities go into the slag.

The process lasts about twenty minutes and the operation is controlled by a man called a "blower."

A slower and more thorough method for making steel sheets was invented soon after the invention of the Bessemer Process. This was called the Open Hearth Process for making steel sheets, which is described in the next lesson.



THE BESSEMER CONVERTOR

LESSON V

OPEN HEARTH FURNACE

WHAT is an Open Hearth Furnace?

An Open Hearth Furnace is the retort where the iron goes through its final refining process.

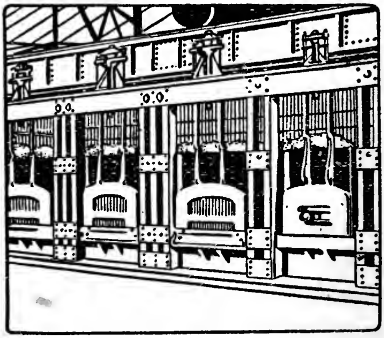
The Open Hearth Furnace is entirely different in appearance and operation from the Blast Furnace.

It looks very much like a huge oven. Usually several furnaces are built together in a single row, and are constructed of fire-brick and steel.

There are two kinds of Open Hearth Furnaces—the Basic Open Hearth and the Acid Open Hearth. The difference lies in the lining and each furnace produces different classes of material.

For some purposes the Basic Open Hearth Furnace is the best while for other purposes the Acid Open Hearth Furnace is better suited.

The Open Hearth Furnace is so called because the hearth or bottom of furnace is exposed to the action of the flame above.



A ROW OF OPEN HEARTH FURNACES

LESSON VI

THE INGOT

AFTER the metal is thoroughly refined in the Open Hearth Furnace or Bessemer Convertor, it is poured directly into a huge ladle, and from there into large rectangular molds, called "Ingot Molds."

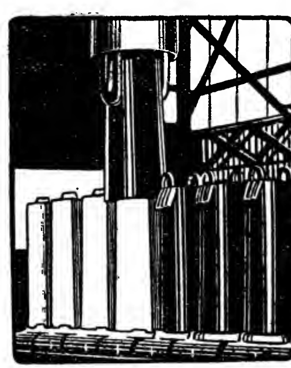
The metal is permitted to harden in the molds, after which the molds are stripped off and the immense rectangular shaped piece of metal is called an "Ingot."

An Ingot weighs from one thousand to eight thousand pounds.

This immense piece of metal is handled entirely by machinery. An electrically operated "stripper" removes the Ingot Mold from the Ingot and the Ingot is lifted by a traveling crane and carried on to the soaking pit.

The soaking pit is a furnace below the floor level into which the Ingot is lowered to be reheated before rolling.

Gases, causing blow holes, and impurities rise to the top of the Ingot. Therefore, the upper portion of the Ingot is cut off before rolling.



STRIPPING THE MOLDS FROM THE INGOTS

LESSON VII

BLOOMING MILL

THE Ingot after being reheated to the proper temperature receives its first actual working in the blooming mill, which consists of a pair of heavy steel rolls, placed one above the other, clothes wringer style.

The drive is so designed that the direction in which the rolls are turning can be almost instantly reversed and the ingot can be passed either forward or backward through the rolls as the operator may desire.

The entire operation of the mill is controlled from an "operating pulpit" similar to the "bridge" of a battleship.

This "pulpit" is equipped with a very ingenious series of control levers by means of which the operators can control the speed and direction of the driving motor, regulate the distance between the rolls by raising or lowering the top roll, and operate a set of giant fingers, known as "manipulators," which turn the ingot over or shift it to any desired position in front of the rolls.

THE BLOOMING MILL

The ingot passes forward and backward between the rolls. Between passes, the operator turns the ingot, by means of the manipulators, so that it is thoroughly worked on all four sides and he also regulates the distance between the rolls in such a manner that after each pass the ingot is reduced in width and thickness and increased in length and is finally converted into a semi-finished piece called a "bloom."

LESSON VIII

THE BAR MILL

AS mentioned in Lesson VII, the blooming mill converts the ingot into a semi-finished piece called a "bloom."

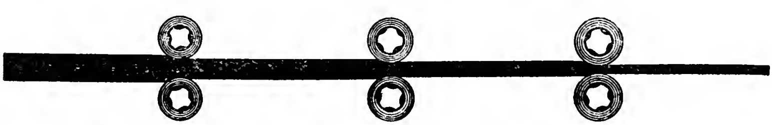
The metal is still very hot and without reheating, it is shifted across the building, by means of a transfer table, to a position in line with the sheet bar mill.

The ends of the bloom are ragged and in addition to this the end which was originally the top of the ingot is apt to contain segregated impurities, so this defective metal is cropped off by means of a powerful shear.

From the bloom shear, the ingot enters the continuous sheet bar mill.

This mill consists of a number of stands of rolls placed in a tandem arrangement, so that the metal passes continuously from one stand to the next. The rolls in each stand are adjusted so that the bar is reduced in width and thickness and increased in length after going through each successive stack of rolls and the bar will be the desired gauge or foot weight when it leaves the finishing pass.

The bar is taken away from the mill on a table equipped with power driven rollers and passes through the "flying shears" where it is cut into thirty-foot lengths without stopping the bar. The bars then pass to the cooling beds from which they are transferred to the stock piles or to cars for shipment to the sheet mills.



CROSS SECTION OF BAR MILL

Showing the reduction in the thickness of the bar as it passes through each stack of rolls.

LESSON IX

SHEET ROLLING MILL

THE sheet rolling mill also resembles a clothes wringer. The rolls are made of special chilled iron and revolve constantly.

The sheet bars are heated to the desired temperature in a large furnace.

Usually two sheets are rolled at one time, except in the case of heavy sheets which can only be rolled one at a time.

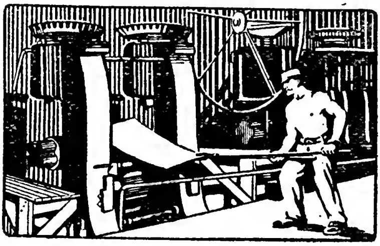
The "Roller" passes the bar through the rolls to the "Catcher" who passes it back over the top of the roll while the second bar is coming through between the rolls. This operation is repeated until a certain thickness is reached and then both partly finished sheets are placed on top of each other and rolled until cold. Then several partly finished sheets are placed together in a "pack," bent double and placed in the sheet furnace to be reheated.

When sufficiently hot the entire pack is passed through the rolls until the desired thickness or gauge is reached.

When cool enough to handle, the sheets are sheared in packs.

The sheets are then separated by hand or with tongs. Frequently the sheets are stuck together so tightly that it is difficult to separate them without using considerable force.

In separating the sheets they become bent and crimped making it necessary to pass them through the "cold rolls."



ROLLING THE SHEET

The cold rolling mill is very similar to the hot mill in appearance. The sheets are passed through the rolls without heating. This straightens out the sheets and improves the surface.

LESSON X

ANNEALING

VERY few sheets are sold as they come from the hot rolls. They must be annealed first.

The annealing process makes the sheet soft and ductile and removes any strains set up in the sheet by too rapid cooling.

The sheets are piled up evenly on an iron base and covered with an iron box so that no air will reach them.

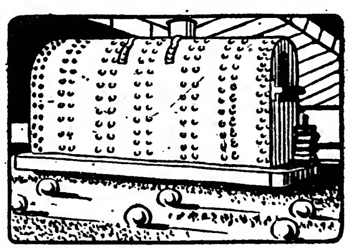
This box, containing the sheets, is run into a large square oven and heated to about fourteen hundred or sixteen hundred degrees, which requires about sixteen or twenty hours.

By means of mechanical devices the heat can be carefully regulated and the cooling process started at just the right time.

When the sheets are annealed the annealing box is removed from the annealing oven but the sheets are not uncovered until they have cooled to exactly the right degree. Oxygen must be prevented from reaching the sheets during annealing or cooling to prevent scale forming.

This process requires great skill and care.

The sheets are now ready for use, unless a galvanized coating is desired.



ANNEALING BOX

LESSON XI

GALVANIZING

COATING sheet metal with hot zinc is called "Galvanizing."

A metal sheet is galvanized as a protection against rust and corrosion; for appearance; and to make soldering of the sheet possible.

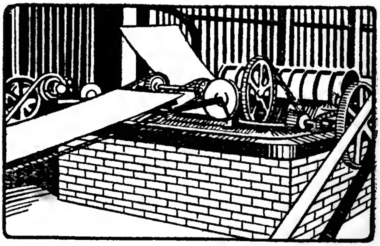
The sheets are first "pickled;" that is, placed in an acid bath to clean the surface thoroughly. Then they are washed in water.

Just before galvanizing the sheets are run through a Sal Ammoniac solution, which helps the hot zinc stick to the sheet.

The sheet is galvanized by passing it through a "galvanizing pot" or large square iron tank filled with molten zinc, or spelter. This is all done by machinery.

The galvanized sheet has a silvery grey, spangled appearance.

The metal sheet is now ready for use.



GALVANIZING SHEET METAL

LESSON XII

TONCAN METAL

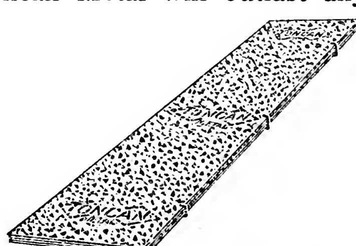
TONCAN METAL is a sheet metal made from iron ore.

But it is different from any other sheet metal because it is rust and corrosion-resisting.

Years ago when Toncan Metal was first produced its ability to combat corrosion was doubted by many. Today it cannot be doubted or disputed because Toncan Metal in actual service for years has proved beyond the shadow of a doubt its wonderful rust and corrosion-resisting properties. This evidence can be procured on request.

The principal reasons for Toncan Metal's durability are homogeneity, purity, careful selection of raw materials and scientific methods of production. This is fully explained in the lessons that follow.

In spite of the fact that Toncan Metal will outlast any sheet metal made from iron ore it costs less than so-called charcoal iron and only a trifle more than steel sheets.



GALVANIZED TONCAN METAL SHEETS

Toncan Metal forms

easily without breaking and welds excellently by any process.

Galvanized, black or blue annealed Toncan Metal can be procured.

Toncan Metal is used for all purposes where sheet metal can be used, for instance—

For building construction—Toncan Metal Roofing, Siding, Eaves Trough, Conductor Pipe, Ventilators, Cornice, Window Frames, Skylights, Lath and Water Tanks.

For railroad work—Culverts, Box Cars, Passenger Cars, Car Roofs, Trestle Coverings, Brine Troughs and Refrigerators.

For road construction—Culverts.

For miscellaneous purposes—Flumes, Silos, Grain Bins, Refrigerators, Signs, Garbage Cans, Stoves, Enameled Ware, Furnaces, Washing Machines, Gas Machines, Gas Holders, Brick Pallets and innumerable other sheet metal products.

TONCAN METAL SHEETS READY TO SHIP

LESSON XIII

THE REASON WHY

FOUR thousand years ago iron and steel sheets were made that lasted for years and years. Evidence of this has been found by scientists.

Research has revealed crude furnaces and tools which were used at that time for iron making.

And pieces of iron and steel have been found that were made four thousand years ago and are still in good condition.

Because of their crude facilities and methods they worked very slowly. Two men made about a dozen pounds of iron a day. And for that reason they could watch every detail.

The analyses of these ancient pieces of iron and steel show that they contain only a very slight percentage of impurities and that whatever impurities are in the material are in proper proportion, evenly and uniformly distributed—or, in other words, the metal is "homogeneous."

This proved that many things were known about iron and steel making in those days that we knew nothing about. The art was lost.

And when more durable sheet metal than steel and iron was demanded prominent scientists investigated.

After years of hard work and careful research they learned (first) why modern steel and iron sheets corroded and (second) why the sheet metal four thousand years ago was so durable.

They found that modern sheet metal was short-lived because it was impure, non-uniform in structure (non-homogeneous) and made carelessly, too rapidly and unscientifically.

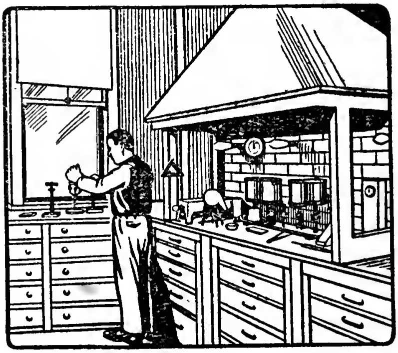
And they learned that the old time sheet metal was so durable because it was pure, uniform in structure (homogeneous) and made carefully, slowly and scientifically.

The greatest task was to determine a method for making a sheet metal in a modern furnace that would be equal to the sheet metal of four thousand years ago—and still keep the cost low.

This, too, was finally accomplished.

A metal sheet was evolved that could resist the ravages of the most severe corrosive influences; a sheet that could be worked, formed up, bent and seamed; a sheet that could be bought by the ultimate consumer at a low price.

Its makers called it "Toncan Metal."



IN THE LABORATORY

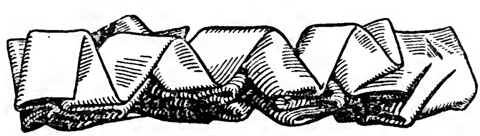
As the good properties of Toncan Metal became known, it created new uses for sheet metal. Products that heretofore had been made of other materials, because sufficiently durable sheet metal could not be procured at a moderate cost, are being made today of Toncan Metal.

The old time iron sheets were durable, it is true, but to combat the smoke, fumes, gases, soot and cinder which fill the air today even more durable sheet metal is needed. And Toncan Metal has been found to withstand these conditions to a degree hitherto considered impossible in an iron ore product.

The sheet metal worker, user, manufacturer, architect and contractor welcomed Toncan Metal with open arms. At last it was possible to procure sheet metal that would give prolonged service at a comparatively low cost. It is indeed a "happy medium" between durable, but extremely expensive sheet metal, and cheap, but short-lived sheet metal.

Science had revived the sheet metal of four thousand years ago. A lost art was found.

Now let us see how this was done.



TONCAN METAL CAN BE FORMED, BENT AND SEAMED WITHOUT BREAKING
(Drawn from a photograph)

LESSON XIV

RUST AND CORROSION

FIRST, we must know that rust and corrosion are different and why they are different.

Rusting is a natural process and cannot be prevented. It is nature's method of returning iron products to their original state—iron oxide. Just as man returns to clay.

And just as man with a strong constitution will outlive the weak man, so properly made sheet metal will outlast carelessly and unscientifically made sheet metal.

Corrosion is different—it is a disease.

First—a reddish-brown spot appears. The spot spreads. The sheet metal flakes off. Pin-holes appear. The holes grow larger. Slowly the sheet crumbles away and finally nothing is left.

That's corrosion—the destroyer of sheet metal. It attacks the weakest sheet metal in its weakest spots.

Toncan Metal is anti-corrosive.

Toncan Metal will rust, however. It must rust because it is an iron ore product. No iron ore product has yet been invented that will not rust.

But Toncan Metal will resist rust better than any other sheet metal made from iron ore.

The coating of rust on Toncan Metal is uniform—no pitting, scaling or flaking off—no holes, for that would be corrosion and Toncan Metal is anti-corrosive.

If a method were devised for preventing tuberculosis in the human race, it would be no more wonderful than Toncan Metal, which conquered the "white plague" of sheet metal—corrosion.

For corrosion is truly a plague—a disease which lays to waste thousands and thousands of tons of iron ore products every year.

The question is often asked "What will happen when our natural supply of iron ore gives out?"

Trees can be planted to take the place of those used up for lumber and paper making, but the iron ore which is used up can never be replaced.

So, we must use the iron ore which nature has given us in the most careful manner. We must reduce the corrosion of iron ore products.

Toncan Metal is a great factor in saving our supply of iron ore for future generations because of its wonderful rust and corrosion-resisting properties.

LESSON XV

PURITY AND HOMOGENEITY

WE have learned that sheet metal corrodes because it is impure, non-uniform in structure (non-homogeneous) and made carelessly, too rapidly and unscientifically.

What are the impurities? What is meant by "Purity"? And what is meant by "Homogeneity"?

The impurities commonly found in iron ore products and dangerous when in excess are Carbon, Manganese, Silicon, Phosphorous and Sulphur.

On the next page is shown the relative proportion of the different impurities in steel.

Manganese in proper proportion to the other elements and in proper quantity is valuable but when present in excess and not in correct proportion it is dangerous.

Sulphur in excess also causes the sheet metal to corrode. Besides it causes the sheet to crack and tear while rolling.

Carbon gives the sheet strength, but too much carbon makes bending and forming difficult.

Too much Phosphorus makes sheet metal brittle.

Traces of Silicon are always present in all iron products.

Compare the amounts of impurities in Steel with those in Toncan Metal as shown on the next page.

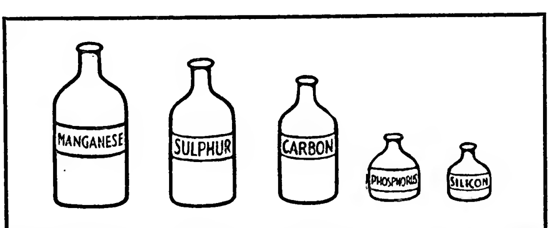
When these impurities group together in different portions of the material they "disagree."

An action is started, similar to the action in the electric battery. In fact this action is known as "electrolysis."

When this happens, the sheet metal decomposes, or corrodes, in spots, as explained in Lesson XIV.

You understand that all the elements mentioned above are always present in iron. Each has its proper function and when present in the right proportion and correct quantity it adds to the value of the iron but if the quantity and proportion are not right the result is harmful instead of beneficial.

No sheet metal can be one hundred per cent pure.



RELATIVE PROPORTION OF IMPURITIES IN STEEL

Toncan Metal is made as near one hundred per cent pure as it is possible to make sheet metal from iron ore.

Toncan Metal is made to that degree of purity which gives the best results.

However, the wonderful rust-resisting qualities of Toncan Metal are due also to the proper proportion and distribution of all elements so that excessive quantities are not present at one or more points.

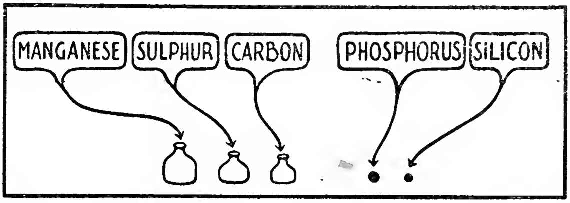
This is called "making the metal homogeneous."

Homogeneity is absolutely necessary.

A pure sheet metal that is not homogeneous is not rust- and corrosion-resisting.

Toncan Metal is both, homogeneous and pure.

Purity and Homogeneity are two important factors in making Toncan Metal the most durable sheet metal made from iron ore. Other factors are also necessary which are mentioned in the next lesson.



RELATIVE PROPORTION OF IMPURITIES IN TONCAN METAL

LESSON XVI

MAKING TONCAN METAL

IT requires at least four weeks to make a Toncan Metal Sheet.

An ordinary metal sheet can be made within a week.

In making Toncan Metal every detail is carefully watched—nothing is hurried.

To begin with, the iron ore for Toncan Metal is carefully selected—not from any one mine, but from mines all over the country. Only the most desirable ore is used.

As the material goes through some of the processes of which we learned in the beginning, it is given special scientific treatment.

Special mill practice is used in making Toncan Metal, and special crews of men make it—men who have had many years experience in sheet metal making.

Analyses and inspections are made at different stages of production to insure material that is up to the established standard of quality. The result is what might truly be called a perfect sheet metal.

It costs considerably more to make Toncan Metal than its moderate selling price indicates.

In the first place, the higher grades of ore cost more than the inferior grades.

Secondly—the special heat treatment and other scientific processes through which Toncan Metal is placed mean an additional expense.

Third—the long continued refining process at an exceptionally high temperature reduces the life of the furnace linings, making frequent replacements necessary.

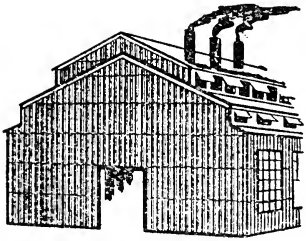
Compare the methods used in making Toncan Metal with the production of steel or so-called iron sheets which are literally shot through the various processes. Compare the four weeks required to make Toncan Metal with the one week for steel.

Is it any wonder that Toncan Metal is so durable? Purity is only one factor. For years the manufacturers of Toncan Metal have worked on the foundation of purity, homogeneity, proper processes and proper temperatures until Toncan Metal became the best possible metal that could be produced.

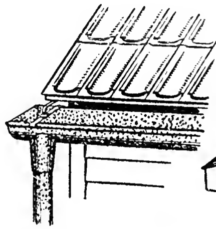
Are the manufacturers satisfied with the results secured? No. In the future Toncan Metal will have the benefit of any change in process, any addition in alloy, or any other factor that will improve it.

LESSON XVII

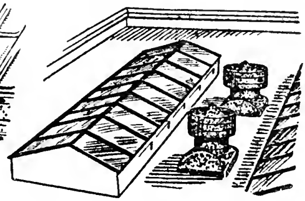
A FEW USES FOR TONCAN METAL



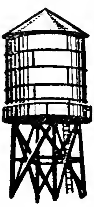
ROOFING AND SIDING



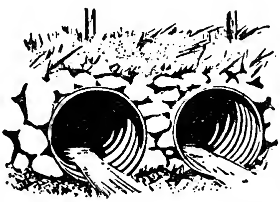
EAVES TROUGH, CONDUCTOR PIPE AND SHINGLES



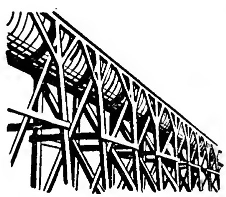
SKYLIGHTS, CORNICE AND VENTILATORS



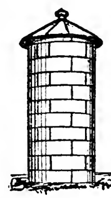
WATER TANK



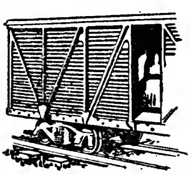
CULVERTS



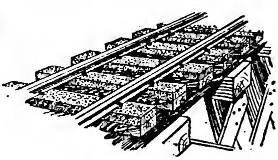
FLUME



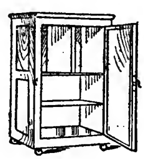
SILO



BOX CAR



TRESTLE AND TIE COVERINGS



REFRIGERATOR

WASHING MACHINE

This trade mark TONCAN METAL *on every sheet*

LESSON XVIII

A PITFALL

"STANDARD gauge" is a meaningless term.

At one time twenty-eight gauge was known as "standard gauge." Then, when lighter gauge was demanded by some users, twenty-nine gauge was called "standard gauge."

Today, if a man orders "standard gauge," he may get anything from twenty-eight gauge to even lighter than twenty-nine gauge. And yet pay for twenty-eight gauge.

It is evident, therefore, that the term "standard gauge" is a dangerous one and should not be used by any buyer who wants full value for his money.

The safest way to order sheet metal, either flat or formed, so as to avoid receiving lighter than twenty-eight gauge is to order Toncan Metal.

Galvanized Toncan Metal is not made lighter than twenty-eight gauge.

So when twenty-eight gauge Toncan Metal is specified the buyer is assured that he will get exactly what he pays for—twenty-eight gauge.

Therefore, the double-diamond Toncan Metal trade mark on every sheet and every formed product assures, not only durability and economy, but honest, full weight sheet metal.

PERTINENT QUESTIONS AND ANSWERS

Question—Why is Toncan Metal galvanized?

Answer—For appearance and double protection just as a good piano is veneered and polished—a good automobile enameled—a good ship painted. But, it must be remembered that Toncan Metal does not depend on the galvanized coating alone for its durability. The durability chiefly lies in the metal itself.

Question—Why is Toncan Metal not guaranteed?

Answer—Toncan Metal does not require a guarantee any more than copper, zinc or nickel. The durability of all these metals is proven and Toncan Metal through its many years of service has proven its extreme durability also. The evidence can be procured from its manufacturers or any Toncan Metal jobber. *Toncan Metal's strongest guarantee is the fact that it needs no guarantee.*

Question—How can a buyer avoid the danger of receiving lighter than 28 gauge when he pays the price for 28 gauge?

Answer—By specifying "28 gauge Galvanized Toncan Metal" the buyer is assured that he will receive no lighter than 28 gauge because Toncan Metal is not made lighter.

Question—Can Toncan Metal be welded?

Answer—Yes. It welds excellently by any process.

Question—Does Toncan Metal rust?

Answer—See Lesson XIV.

Question—Does manganese have any special value in the manufacture of sheet metal?

Answer—Yes, manganese in proper proportion and quantity is valuable as it neutralizes the bad effects of sulphur on the working qualities of the hot steel and facilitates rolling. An excess of manganese, however, has a harmful effect and lessens corrosion-resisting qualities of the metal.

Special processes used in manufacturing Toncan Metal regulate manganese to just the right point to secure only the results which are desirable.

Question—How can evidence of Toncan Metal's durability be procured?

Answer—Photographs of buildings and other places where Toncan Metal has been in use for years are contained in a book entitled "Better Sheet Metal." This book will be sent on request free of charge by any jobber of Toncan Metal or by the manufacturers themselves. Evidence of actual service is the best test for any material. It shows at a glance what would otherwise require years to determine.

Question—Why should a dealer be anxious to sell and use Toncan Metal?

Answer—The housewife patronizes the grocer, butcher, milliner and other dealers who give her *goods of just a little better quality than she actually expects.* And her husband does likewise. It's human nature. *By recommending* and using Toncan Metal, the sheet metal man gains the customer's confidence and gratitude. And the advertisement he receives when his customer tells his friends, relatives and neighbors helps to increase his business and profits.

Question—Why should an architect specify Toncan Metal?

Answer—Before the advent of Toncan Metal, an architect had nothing to offer the client who wanted a durable material at a low cost—nothing between high priced copper and cheap, short-lived steel or iron sheets. Toncan Metal is a "happy medium" and gives the user both durability and economy. See "Better Sheet Metal" for partial list of prominent architects specifying Toncan Metal.

Question—How are Toncan Metal Sheets and Formed Products identified?

Answer—All Toncan Metal sheets are stencilled in red as follows:

THE STARK ROLLING MILL CO.
CANTON
O.
TONCAN
METAL
REG. U.S. PAT. OFF.

And all Toncan Metal Eaves Trough, Conductor Pipe, Elbows, Shoes, Cut-offs and Mitres should bear the following die stamped inpression:

TONCAN
METAL
MAKERS NAME

ADDENDA

As the Primer is very elementary in character and devoted primarily to the description of the processes necessary for the production of sheet metal, we have added the "Iron and Steel Metallurgy in Brief." This gives a brief but comprehensive list and definition of the various general terms and processes used in the entire iron and steel industry. For the use of this summary we are indebted to the courtesy of the publishers of the Steel and Metal Digest.

IRON AND STEEL METALLURGY IN BRIEF

From Ore to Finished Product

Iron Ore—Contains Iron and Oxygen and impurities. Smelted in Blast Furnace, removing Oxygen and part of impurities and adding Carbon, makes....Pig Iron

Foundry Pig Iron—Melted in Cupola and cast makes ....Iron Castings

Iron Castings—Made from Malleable Pig Iron and heated in Scale, make ....Malleable Castings

Grey Forge Pig Iron—Melted in a Puddling Furnace, then balled, squeezed and rolled, makes ....Muck Bar

Muck Bar—Or Wrought Scrap cut into short lengths, piled, heated and rolled, makes ....Wrought Iron

Muck Bar—Treated as above and rolled into strips, makes ....Skelp Iron

Skelp Iron—Bent into the shape of tubes and welded, makes ....Iron Pipe

Muck Bar—Or Steel melted in a Crucible with Charcoal, makes Carbon Steel, Tool Steel or ....Crucible Steel

Bessemer Pig Iron—Direct from Blast Furnace or melted in Cupola, poured into Convertor, with air blown through it to burn out the impurities makes ....Bessemer Steel

Pig Iron—Molten, or in pig, with or without Scrap, when purified in Open Hearth Furnace makes ....Open Hearth Steel

Low. Phos. Pig Iron—Treated as above in an acid (Silica or Sand) lined furnace makes ....Acid O. H. Steel

Basic Pig Iron—Treated as above in a basic (Dolomite) lined furnace to remove Phosphorus makes .... Basic O. H. Steel

Pure Iron—The product of a Basic Open Hearth furnace refined to a point where the impurities are reduced to the least practicable minimum is .... Toncan Metal

Toncan Metal—Is poured into ingot molds making ...... Ingots

Ingots—Are rolled into .... Blooms or Billets

Ingots—Are rolled into .... Slabs

Blooms—Are rolled into .... Rails

Blooms—Are rolled into .... Structural Shapes

Slabs—Are rolled into .... Plates

Billets—Are rolled into .... Bars and small shapes

Billets—Are rolled into .... Steel Skelp

Billets—Are pierced, rolled and drawn through dies, making .... Seamless Tubes

Billets—Are rolled into .... Rods

Steel Skelp—Bent into the shape of tubes and welded makes .... Steel Pipe

Rods—Are drawn through dies into .... Wire

Rods—Are headed into .... Rivets and Bolts

Rods—Are welded into .... Chain

Wire—Is made into .... Nails and Fencing

Ingots—Are rolled into .... Sheet Bars

Sheet Bars—Are rolled into .... Black Sheets

Black Sheets—Cleaned, cold rolled coated with Tin makes .... Tin Plate

Black Sheets—Cleaned, cold rolled coated with Lead and tin makes .... Terne Plate

Black Sheets—Cleaned, cold rolled and coated with Spelter (Zinc) makes .... Galvanized Sheets

All Sheets—Can be stamped into .... Various Forms