RUSTLESS IRON.

THE WELLS RUSTLESS IRON WORKS,

OFFICE,

9 CLIFF STREET, NEW YORK CITY.

WORKS AT

LITTLE FERRY, N. J.

(NEAR JERSEY CITY.)

TRADE

"RUSTLESS,"

MARK.

Catalogue and Price List

—OF—

THE WELLS

RUSTLESS IRON WORKS

Improved **BOWER-BARFF** Process.

OFFICE,

7 & 9 CLIFF ST., NEW YORK CITY.

Works at LITTLE FERRY, N. J.

(NEAR JERSEY CITY.)

Pell Print, 92 John St., New York.

LOCATION OF WORKS

AND

RAILROAD CONNECTIONS.

Our Works are situated about eight miles from the New York City Hall, on the lines of The West Shore Railroad, The New York, Ontario & Western Railroad, and the New York, Susquehanna and Western Railroad, and close to the Hackensack River, which has a depth at this point of about twenty-five feet.

By special arrangements with the Railroad Companies all freight is unloaded and loaded at the factory platform, thereby avoiding handling.

Freight leaving New York City at five P. M. is unloaded at works at six o'clock next morning. Freight leaving LITTLE FERRY at six P. M. is delivered to consignee the following morning.

By agreement with Railways we have direct and cheap railroad connections with the following points:

Newark and Trenton, N. J., Philadelphia, Pa., Baltimore, Md., and all points on line of *The Pennsylvania Railroad.*

Also, with Albany, N. Y., Boston, Mass., Providence, R. I., Hartford, Conn., Buffalo, N. Y., Detroit, Mich., Chicago, Ills., and other Western Cities.

Consequently, the item of freights is reduced to a minimum.

"RUSTLESS" IRON.

Iron and Steel made "Rustless" through treatment by the BOWER-BARFF process has been in the European markets for a numbers of years, and in this market for about four years. By the Bower and Barff processes the surface of the metal is converted into a Magnetic Oxide of Iron. This oxide is well known in its natural state as Magnetic Iron ore, and has withstood without deterioration *Centuries* of exposure to *Fresh* and *Salt Water.*

The Barff process consists in subjecting the articles to be treated to the action of superheated steam.

The Bower process forms the magnetic oxide by subjecting the Iron articles successively to the action of highly heated air and carbonic oxide gas derived from coal fires. The hot air converts the surface into red oxide of iron, which is reduced to the black, or magnetic, oxide by the gas.

No foreign material such as *paint* or *alloy* is applied to the metal, so that the coating is perfectly pure.

The cost is less than that of Galvanizing or Enameling.

Surfaces of Iron and Steel treated by the BOWER-BARFF processes have a pleasing blue-gray or blue-black color, and if the article is polished before treatment it has a lustrous ebony black finish, which gives a beautiful effect.

PREPARATION OF THE IRON.

Certain points in the preparation of the iron for treatment are observed to insure satisfactory results.

(1) Foundry sand, if left on castings, generally bakes to a reddish brown color in the furnace, producing unsightly, rust-like spots. Where the appearance of the article is of no consequence, this is not in itself an objection, but wherever the coating is to serve as a finish, the foundry sand must be removed by pickling and cleansing with a steel brush, or by thorough milling, prepartory to treatment. Care must be observed to thoroughly remove all pickle by washing in hot water after withdrawing the articles from the pickling vat. A dilute sulphuric or hydrochloric acid solution (3—5 per cent. acid) makes a good pickle, in which the castings are immersed only just long enough to loosen the adhering sand—or about ten to twenty minutes. Over-pickling is in every way objectionable.

(2) In treating wrought iron a handsome appearance of the oxydized ware is only obtained by removing all forge or rolling-mill scale before treatment. Pickling and brushing accomplish this, but for a large class of ordinary ware the expense of this preparation is not incurred, and only the loose scale is brushed off the articles before treatment.

(3) Articles which are to have a bright polished surface, must be polished to the full extent desired *before* treatment in the furnace.

(4) Blow-holes or other defects in castings must not be plugged with lead, for the action of lead in the furnace is decidedly injurious to the iron. Only brass or iron plugs can be used.

(5) The iron generally undergoes a very slight permanent expansion in the furnace, but this is not sufficient to require any special fitting or loose threading of screws, except in cases of very tight, accurate fit. In columns and stair stringers for architectural work, in which slight errors multiply by repetition, a scant measurement of $\frac{1}{32}$ inch per foot has been found to allow sufficiently for permanent expansion.

(6) All drilling of holes, trueing of faces, etc., must be done *before* treatment, to save the magnetic oxide coating from the injury which subsequent fitting would cause.

PROPERTIES OF "RUSTLESS" IRON.

The magnetic oxide coating is very hard, but comparatively inelastic. It withstands the wear due to friction, but is injured by blows of the hammer and rough usage. Wherever from this cause the coating is chipped the iron rusts, though the rust remains localized; it does not spread or raise the coating as is the case with paint or electro-deposits or galvanizing.

The protection of the iron being due to a *superficial* layer of magnetic oxide, and not to anything penetrating the metal (which would weaken it), it follows that any manipulation that would injure or destroy the continuity of the surface of the iron, must necessarily prove destructive of the coating. In riveting, for example, the coating in the immediate neighborhood of the rivet-holes suffers; similarly, in driving nails through sheet iron roofing, the oxide is chipped at the holes; in fitting *"Rustless" Gas and Steam Pipe* the outside coating is slighty injured by the bite of the wrench and vise unless these are furnished with lead or copper cheeks; in shearing, it scales along the edge of the metal, and in flanging or bending sheet iron the coating on the line of the bend is cracked. The limit of elasticity of the oxide is practically the same as that of the iron; it adheres firmly to the metal under tensile and compressive strains until this limit has been reached, and no further.

A piece of "Rustless" iron can be heated to redness and then plunged into cold water without the least scaling or other change, while coverings of paint, tin, galvanizing and enamel suffer very much under such action. For this reason *"Rustless" Hollow Ware* is more *readily cleaned* than even enamel ware; the latter must be allowed to cool after use; and the remains of food in it become dried and congealed, and stick to the utensil, necessitating considerable scraping and involving danger of injuring the enamel.

Magnetic oxide withstands the action of many brines, alkalies, sulphuretted gases and weak, organic acids, but it is gradually dissolved by sulphuric and hydrochloric and other powerful acids. The corroding action of these acids, however, is considerably retarded on "Rustless" iron, and hence such iron has been successfully used in chemical works where it was exposed to strong acid fumes.

Coated articles have been exposed for years without the slightest deterioration to sea-water and to the most varied atmospheric conditions. Cast iron urinals, used for ten months in the yard of an iron works, have remained perfectly free from corrosion.

MR. W. T. WELLS, having spent the last two years in very costly experiments with the above process, has so improved it that we believe we can now offer the public the very best "Rustless" Iron work in the market.

We are prepared to treat all kinds of Iron and Steel. The treatment is specially well adapted to the following lines of work: Parts of Engines,

Grate Frames and Railings, Architectural Iron Work, Ornamental Iron Work, Plumbers' Iron Work, Iron Work exposed to destructive gases and fumes, Ship Work, Culinary Utensils, Cast Iron Water and Drain Pipe, Wrought Iron Gas and Water Pipe, Drive-Well Pipe, Highly Polished Iron Work of all kinds, &c., &c., &c.

Bronze Medal Awarded for "RUSTLESS" Hollow Ware, by American Institute, 1884.

New York, March 1st, 1886.

"RUSTLESS"

IRON WATER PIPE.

This Pipe can be cut and threaded the same as ordinary pipe.

The Reason Why

"RUSTLESS" IRON PIPE

Is superior to all others for conveying water.

First. Lead Pipe is poisonous, as the oxide of lead mixes with the water and COLLECTS in the system of the person drinking it.

Second. Galvanized Pipe is ordinary pipe covered with ZINC. Water acts on the zinc and forms a poisonous combination with it, and this is also a CUMULATIVE poison and remains in the system.

Third. Calamined or Kalameined Pipe is iron pipe coated with a mixture of LEAD and some other ingredients, but consisting principally of LEAD. Iron coated with lead is just as bad for use as common lead pipe—in fact, it is a little worse, as the iron and lead have a repulsive action toward each other which tends to throw off the lead.

Fourth. Pipe to be properly galvanized, so that it will be rustless must be thoroughly cleaned of scale; this it is almost impossible to do, so it is only the *outside* of galvanized pipe which is rust-proof, and the inside will often rust just as badly as common pipe.

Fifth. "Rustless" Iron Pipe is pipe the surfaces of which are changed from ordinary iron to the magnetic oxide of iron. This oxide is not affected by water and is absolutely free from poisonous compounds. The inside of the pipe is as thoroughly treated or oxydized as the outside. The work being done by *heat* and *gas* and *superheated steam*, every part and crevice is reached by the treatment; hence, "Rustless" Iron Pipe is the very best for conveying water.

NOTE.—"Rustless" Wrought Iron Water Pipe is already being largely used to pipe first-class dwellings, to the exclusion of lead or other pipes.

NOTE.

The Magnetic Oxide of Iron being absolutely free from all poison is specially well adapted for use as a lining for water pipes. Galvanized Iron and Lead Pipes are acted upon by the water and the Oxides of Zinc and Lead mix with the water.

TERMS OF SALE.

Our terms to dealers of good standing are thirty days, with an allowance of one per cent. for prompt cash.

Parties unknown to us must accompany their orders with satisfactory reference; or with Check, Draft, or Post Office Order, covering amount of bill.

"RUSTLESS"

Wrought Iron Water, Gas and Steam Pipe.

NOTE.—This Pipe can be cut and threaded as readily as ordinary pipe.

BUTT-WELDED.

Size, Inches	¼	½	¾	1	1¼
Price, per Foot	3¼c.	4¾c.	6c.	8c.	11c.
Weight, "	.42	.84	1.12	1.67	2.24

Discount.....per cent.

LAP-WELDED.

Size, Inches	1½	2	2½	3	3½	4	4½	5	6
Price, per Foot	21c.	26c.	42c.	55c.	67c.	83c.	$1.00	$1.20	$1.50
Weight, "	2.60	3.61	5.74	7.54	9.00	10.66	12.34	14.50	18.75

Discount.....per cent.

FITTINGS.

Size of Pipe.....Inches,	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
ELBOWS	..	.04	.05	.06	.09	.13	.20	.25	.40	.75	1.10	1.35	1.80	2.50	2.85	3.90
REDUCING ELBOWS	..	.05	.06	.07	.11	.16	.23	.29	.46	.85	1.25	1.50	2.10	3.00	3.25	4.50
45° ELBOWS	..	..	..	.10	.15	.20	.26	.35	.50	1.30	1.60	1.90	2.50	3.50	4.50	5.50
TEES	..	.06	.07	.09	.13	.20	.30	.38	.60	1.10	1.50	2.00	2.50	3.50	4.00	5.50
REDUCING TEES	..	.07	.08	.11	.15	.23	.35	.44	.70	1.25	1.75	2.30	2.90	4.00	4.60	6.35
CROSSES	..	..	.10	.12	.18	.28	.40	.50	.80	1.50	2.20	2.70	3.50	5.00	5.70	7.80
REDUCING CROSSES	..	..	.12	.14	.21	.32	.46	.58	.92	1.70	2.50	3.00	4.00	6.00	6.60	9.00
RETURN BENDS, close	..	..	..	.10	.15	.22	.34	.45	.75	1.50	2.25	....	....	....	....	....
" open	..	..	..	..	.20	.30	.48	.68	1.15	1.75	2.75	....	....	....	....	....
MALLEABLE IRON UNIONS	..	.15	.18	.20	.28	.34	.46	.60	.80	1.50	2.10	3.00	4.00	....	....	....
FLANGE UNIONS, complete	..	..	..	.60	.65	.70	.85	1.15	1.50	1.75	2.25	2.75	3.15	4.50	5.00	6.50
BUSHINGS	..	.05	.05	.06	.07	.09	.13	.17	.27	.42	.60	.80	1.00	1.50	1.85	2.50
PLUGS	..	.03	.03	.04	.05	.06	.10	.13	.20	.35	.50	.75	.85	1.35	1.75	2.40
CAPS	..	.03	.03	.05	.08	.11	.15	.22	.30	.50	.80	1.10	1.30	1.60	2.00	2.35
NIPPLES, shoulder or close	.05	.05	.06	.07	.09	.10	.14	.17	.25	.56	.75	1.00	1.25	1.75	2.00	2.75
" long	.07	.07	.09	.10	.11	.15	.20	.25	.35	.75	.95	1.25	1.60	2.25	2.60	3.60
" s. or c., right and left	.10	.10	.10	.12	.15	.18	.24	.30	.40	1.00	1.25	1.50	1.75	....	....	....
WROUGHT IRON COUPLINGS	.05	.05	.06	.07	.10	.13	.17	.21	.28	.40	.60	.80	1.00	1.50	1.65	2.40
Reducing ditto	..	.04	.06	.09	.12	.18	.25	.36	.50	.75	1.20	1.50	2.00	2.50	3.00	4.00
Right and Left ditto	.07	.07	.08	.11	.15	.20	.25	.30	.50	.85	1.20	1.60	2.00	....	....	....
LOCKNUTS	..	.04	.04	.06	.07	.08	.10	.12	.25	.40	.50	.70	.95	1.25	1.35	1.90
LONG SCREWS	..	.30	.35	.40	.55	.75	1.00	1.30	1.70	2.70	3.70	5.40	6.60	....	....	....
Y BRANCHES	..	..	..	.25	.30	.40	.60	.90	1.25	2.25	3.25	4.50	6.00	....	9.00	12.00
WROUGHT IRON BENDS	..	..	..	.28	.37	.56	.77	1.12	1.65	....	....	....	....	....	....	....

Discount.....per cent.

LIGHT

Artesian Well Tubing or Oil Well Casing.

Inside Diam. Nominal, Inches.	Outside Diam. Actual. Inches.	Weight Per Foot, Nominal.	Price, Per Foot.	Inside Diam. Nominal, Inches.	Outside Diam. Actual, Inches.	Weight, Per Foot, Nominal.	Price, Per Foot.
2	2¼	2.23	$0.25	4¾	5	7.25	$0.72
2¼	2½	2.75	.28	5	5¼	7.66	.79
2½	2¾	3.00	.31	5 3/16	5½	8.08	.86
2¾	3	3.33	.34	5⅝	6	9.35	1.00
3	3¼	3.95	.38	6¼	6⅝	10.06	1.30
3¼	3½	4.27	.43	6⅝	7	12.45	1.45
3½	3¾	4.60	.45	7⅝	8	15.10	1.85
3¾	4	5.33	.52	8¼	8⅝	16.15	2.10
4	4¼	5.50	.56	8⅝	9	17.25	2.25
4¼	4½	6.00	.60	9⅝	10	19.00	2.75
4½	4¾	6.50	.66				

DRIVE-WELL PIPE.

Inside Diam., in.	Weight, Per Foot.	Full Lengths, Price, per Foot.	Half Lengths, Price, per Foot.	Third Lengths, Price, per Foot.
1¼	2.70	.21	.23	.24
1½	3.24	.25	.27	.29
2	4.26	.32	.34	.35
2½	6.89	.49	.52	.55
3	8.74	.65	.68	.71
3½	10.18	.84	.88	.93
4	11.89	1.03	1.09	1.15
4½	13.36	1.21	1.29	1.37
5	15.32	1.35	1.47	1.59
6	18.76	1.80	1.95	2.10
7	23.27	2.33	2.56	2.79
8	28.18	3.15	3.46	3.76

Full lengths range from 13 to 14 feet. Half lengths range from 7 to 8 feet.
Third lengths range from 4 to 5 feet.
Each length is fitted with one coupling without extra charge.

SOCKETS FOR DRIVE-WELL PIPE.

Size, Inches	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8
Price, each	.18	.22	.30	.35	.40	.48	.57	.66	.96	1.12	1.60	2.72

ALL KINDS OF

Valves and Fittings

SUPPLIED

AT LOWEST MARKET RATES.

"RUSTLESS"

IRON BODY VALVES,

With Brass Mountings,

TREATED TO ORDER.

IRON AND STEEL

TREATED BY THE BOWER-BARFF PROCESS.

Press Comments

and

Testimonials,

Etc.

PRESS COMMENTS.

The following extracts are taken from an article which appeared in the *Revue Universelle*, published in Belgium.

After describing the furnaces and chemistry of the process, the writer says:

The "Rustless" articles withstand the effects of heat, while coverings of paint, galvanizing, tin and enamel suffer very much under its action. A piece of "Rustless" iron can be heated to redness, and then plunged into cold water without the least scaling or other change, so slight is the difference between the co-efficients of expansion of the magnetic oxide and the metal.

"Rustless" iron is not affected by fresh water holding air in solution, nor by brines or alkaline solutions or sulphuretted gases, and it withstands the action of salts in general, especially sulphate of copper.

Coated articles may therefore be exposed to sea water or to the most varied atmospheric conditions. Cast iron receivers used for six months as urinals remained perfectly free from corrosion, while similar receptacles not protected by the oxide were strongly attacked.

VAN AUBEL, engineer of the Maestricht Royal Paper Factory, treated several articles, and then exposed them to the fumes of the laboratory without any deteriorations.

FLAMACHE, engineer of the Belgian State Railways, makes the following statements in a report on the BOWER process:

(1) Hydrochloric acid deluted to $\frac{1}{10}$ converts the magnetic oxide into sesquioxide which it dissolves, and into hydrated sesquioxide which scales off the surface, exposing the metal to the direct action of the acid.

(2) Nitric acid diluted to $\frac{1}{10}$ does not act on "Rustless" iron.

(3) A solution of caustic soda has no effect on the coating. If there is a crack in the coating, the exposed metal will rust as usual, but the rust will remain localized.

Though the adhesion of the BOWER-BARFF coating is considerable it is not sufficient to permit of working and fitting iron in the same way as material that has not been treated. "Rustless" nails can be driven into wood and then withdrawn without injury to the coating. Coatings can be drilled without injuring the coating on the rim of the holes.

FLAMACHE, claims to have obtained the following results:

(1) The "Rustless" treatment does not alter the strength of the Iron.

(2) Under tensile or compressive strains the oxide adheres firmly to the iron until the limit of elasticity of the metal has been reached.

(3) The oxide is chipped off the metal by a blow of the hammer; in riveting the coating to a distance of one centimetre around the rivet heads scales off; and in shearing the coating scales along the edge of the metal.

According to these tests iron can be protected from rust when the articles are not to be submitted to subsequent mechanical treatment.

EXTRACT FROM "THE LONDON TIMES," 6th MARCH, 1877.

Many attempts have been made to protect iron surfaces by the application of some kind of paint or varnish; and these attempts have, of course, been to some partial extent successful. Such coatings, however, have no real adhesion to the metal on which they are placed, and are liable to scale off or to perish in a variety of ways. Even when the coating is generally sound, the smallest flaw in its continuity will give entrance to the enemy; for the rust from the exposed spot will spread laterally under the coating and may be all the more dangerous and destructive from being partially concealed from view.

The oxidation does not affect the appearance of the surface in any other way than by turning it black. A rough forging retains its roughness, and a turned and polished surface retains its smoothness. If there should be any flaw in the coating, or if the black oxide is designedly removed from part of the surface, the common oxidation will occur where the iron is thus left unprotected; but such oxidation is strictly limited to the unprotected portion, and has not the smallest tendency either to spread laterally or to detach this from the subjacent parts.

EXTRACT FROM "THE ENGINEER," LONDON, 7TH MAY, 1880.

To say that the black oxide is indestructible under the ordinary influences of the weather is to state a truth known for many years to chemists. The articles which we have seen have a coating of this oxide, not existing there as a scale, but apparently incorporated with their substance. It would be but a waste of time to point out the enormous advantage that will accrue from rendering iron castings as incorrodible for all practical purposes as gold. The special feature of the process is its simplicity of application. For a very moderate sum cast iron can be rendered indestructible with certainty and despatch.

FROM "THE BUILDER," LONDON, 8TH JUNE, 1878.

The coating has been subjected to the severest tests, and has invariably resisted all attacks of both air and moisture, and there is every reason to believe that this process will, when completely developed, entirely supplant every other method of protecting iron from rust.

EXTRACT FROM "THE LANCET," LONDON, 16TH NOVEMBER, 1878.

Its application to sanitary purposes is obvious; it will be a great boon to have water-closet pans, soil pipes, traps and urinals which do not corrode. We saw a urinal which had been in use for many weeks, and upon which, curiously enough, the urine had not even left a stain; the later fact is very strange, and not very easy of explanation. For water pipes the black oxide will be invaluable, and also for water cisterns. For cooking it is quite equal to copper, and does not lead to the occasional danger of copper poisoning, which arises when copper utensils are employed. For making pickles we believe it is necessary, or at least it is the custom in large factories, to use vessels of platinum, the cost of which is enormous.

FROM "THE HARDWARE TRADE JOURNAL."

Enormous quantities of iron tubes are being treated by the new process with uniform success; and it has been found very suitable for the treatment of stable and harness room fittings in iron, thus dispensing with the more costly process of enameling the surfaces hitherto pursued.

Extracts from Letters and Testimonials.

FROM T. MAXWELL WITHAM, ESQ.

5 GRAY'S INN SQUARE, LONDON, March 10th, 1879.

The portions of roller skates treated by your process have given great satisfaction. Before being so treated it occupied one man to keep them free from rust, as the skates are at Ostend, and the rink close to the sea: but since they have been treated they are quite free from rust. The skate fittings you treated for me personally have also given great satisfaction, but these have not been submitted to the action of the sea air like those at Ostend.

THE CITY OF CARLISLE GAS WORKS (MR. J. HEPWORTH, ENGINEER.)

March 19th, 1879.

The pieces of pipe treated were placed in a humid atmosphere, and I find that they present no change in appearance whatever.

NOTE.—This was twelve months' trial.

FROM MR. J. J. BOWREY, GOVERNMENT CHEMIST, KINGSTON.

DEAR SIR: KINGSTON, JAMAICA, 11th March, 1879.

Your letter, dated January 18th, reached me too late for me to reply by last mail, and I fear this letter will get to you after, and not before, you read your paper. I arrived here early in May last, and since then the protected iron articles you gave me have been placed as follows: The iron horse has stood in doors at my house, and is as perfect as ever—quite free from rust—and so are the screws and bolts; these latter have been exposed to the air of my balance room. A pair of ordinary steel scissors,* which have laid on the same shelf as the screws, but wrapped up in tissue paper, are, I now find, a good deal rusted (they were bright when I brought them out, and have not been disturbed until yesterday.) The gate handles and ventilating plate have been the whole time freely exposed to the sky and to the rain and sun. We have had rain one day out of two, I think, since May. The handles are free from rust, excepting a few pin points. One handle I broke; of course the broken surfaces have rusted freely. The plate shows a little more rust, but it is on upper sharp angles, where I suspect portions of the protecting film have been broken off by the plate being trodden on. In my balance room I have a slab of polished cast iron on which to cool crucibles, and it has to be polished once or twice a week to keep it free from rust; if exposed to the weather it would be covered with rust in a single rainy day. I remain, yours very truly,

JOHN JAMES BOWREY.

* These were not coated.

FROM THE SILBER LIGHT COMPANY, LIMITED.

49 WHITECROSS ST., March 11th, 1879.

We have subjected the lamp stands (nine in number) to an ordinary test, viz.: exposure in a damp place, and on examining them a few days ago could trace no apparent alteration in their appearance, and certainly there was not the slightest sign of rust. These were received by us from you on October 22d, 1878.

FROM THE RIGHT REV. DR. STEERE, BISHOP OF ZANZIBAR.

ZANZIBAR, 26th March, 1879.

MY DEAR SIR:

We have had here for over half a year some specimens of your mode of treating iron, and they have kept a good surface, though our climate, being hot and damp, with a constant breeze from the sea, is one in which iron rusts rapidly.

I am, yours, ever sincerely,

EDWARD STEERE, *Missionary Bishop.*

FROM MESSRS. SMITH & WELLSTOOD, AMERICAN STOVE MANUFACTURERS, GLASGOW.

4th May, 1880.

We take great pleasure in telling you that, in our judgment, your process for oxidizing the surfaces of iron manufactures is a complete practical success in preventing the slightest appearance of rust. We have had in use and under test in every way we could think of, for the last six months, one of our portable cast iron farm and laundry boilers, (a 22-gallon size) coated by your oxidizing process, and not a sign of the least rust or the slightest discoloration of pure clean water has at any time shown itself, although the said boiler has several times been standing out of use for weeks, with portions of water in it to induce rusting. Another test we have given it, and which satisfies us of its value, is by several times firing the boiler with only a small portion of water in it, thereby exposing all above the water line to a strong heat, and without any perceptible injury to the surface coating, and this is certainly what neither the galvanizing nor the enameling process would stand.

COPY OF A LETTER FROM F. J. EVANS, ESQ., M. I. C. E., ENGINEER OF THE GAS LIGHT AND COKE WORKS, BECKTON.

HORSEFERRY ROAD, WESTMINSTER, 18th May, 1879.

MY DEAR SIR:

I have received the very nice specimen of your process for the production of cast iron, and trust you will succeed in making it a profitable thing, as it deserves to be.

I return you the cast iron dragon you sent me nearly two years since, which has been exposed in the open air all that time, and shows no signs of oxidation; in fact, it is as perfect as when you sent. I may add that every shower of rain, hail, sleet or snow that fell during that time necessarily wetted every part of it.

Yours very truly,

(Signed) J. F. EVANS.

FROM MESSRS. JOHN DEWRANCE & CO., ENGINEERS.

158 GREAT DOVER STREET, BOROUGH, March 18th, 1879.

We have tested your patent coating for iron surfaces in the most severe way, and we found it impossible to rust the iron where the coating was intact. We consider it a very valuable invention, and capable of most varied application.

FROM MESSRS. JOHN WARNER & SONS, HYDRAULIC AND SANITARY ENGINEERS.

THE CRESCENT FOUNDRY, CRIPPLEGATE, LONDON,
March 6th, 1879.

The closet pan which you covered for us and which was sent to us in November, 1878, we have exposed to the atmosphere ever since—four months ago. It has been placed so as to be exposed to snow, frost, rain and smoke, and we do not see the slightest appearance of rust or detriment. We have purposely subjected this piece to this particular test in order that we may decide as to the adaptation of the process to some other articles. We are so satisfied that it will be what is wanted for this particular purpose which we have in view, that we have fully decided on the matter, and shall take the opportunity of calling upon you in a few days, when we will fully discuss the arrangements which may be made as to the future.

FROM MESSRS. JOHN DEWRANCE & CO.

158 GREAT DOVER STREET, BOROUGH, LONDON,
July 19th, 1881.

Your favor of the 16th is duly received; we have much pleasure in stating that we have used Professor BARFF's process for protecting iron from rust for the plugs of our Patent Asbestos Packed Cocks for nearly two years, and have found same most satisfactory in every respect.

FROM MESSRS. CROMAR, SCOTT & CO., LIVERPOOL.

September, 1880.

The tubes have been for over twelve months fully exposed to the fumes of acid, ammonia, etc., incidental to a galvanizing works, and the results have been highly satisfactory.

From the Engineers of the following Gas Companies in 1880:

THE HORNSEY GAS COMPANY.—I have had your tubes for twelve months in an atmosphere most trying to iron work, and they are not affected.

THE CRYSTAL PALACE GAS COMPANY.—I have had some of your tubes laid for upwards of twelve months in ashes, exposed to air and moisture, and except where the coating has been disturbed by violence, the tubes do not show the slightest signs of corrosion. It is well known that such ashes have a most destructive effect upon ordinary tubes.

THE NICTHEROY GAS COMPANY IN 1881.—I have uncovered a service laid with tubes coated by BARFF's process, which was laid over eighteen months ago, and it is free from rust, and as clean as when first laid.

FROM MESSRS. JNO. HARDMAN & CO., ART METAL WORKERS, BIRMINGHAM.

April 27th, 1881.

We have used for over a period of two years the BARFF process, and have found it to fulfill all our requirements. We have had bell-pulls, hinges, etc., exposed to all kinds of weather, and they stand without any apparent change.

FROM "THE METAL WORKER," NEW YORK.

MAGNETIC OXIDE OF IRON.—A correspondent in Baltimore writes us as follows: "Please explain in THE METAL WORKER what is 'magnetic oxide,' and oblige many readers, who would like to see a simple, plain explanation."

Magnetic oxide of iron is chemically known as proto-sesqui oxide, having as its symbol $Fe_3 O_4$—indicating that it is a compound of iron and oxygen in the proportions of three equivalents of the former to four of the latter. It is a fixed and stable compound, and cannot take up any more oxygen under ordinary conditions; consequently, it is said to be rustless—that is, other oxides cannot form until the compound $Fe_3 O_4$ is broken up. Among all the compounds of iron it preserves the greatest resistance to the action of the air and moisture, and to acids and chemicals generally, and remains unchanged for indefinite periods under ordinary conditions. It occurs in nature, often in great masses, as the iron ore known as magnetite, generally the richest, but also the most refractory, of iron ores. It is deep black in color, and very hard. It is called magnetic oxide, because pieces of magnetite often exhibit the property of attracting metallic particles, and is known then popularly as loadstone. Cast iron, wrought iron, and steel, when coated with a thin layer of it, are protected by it against rust. Magnetic oxide is formed on the surface of iron by heating it to bright redness and then subjecting it to the action of steam. This is known as the Bower-Barff process for rendering iron rustless.

FROM "THE METAL WORKER," NEW YORK.

GALVANIZED IRON WATER PIPES.—In the course of a paper on the above subject by Dr. F. P. Venable, in the *Journal* of the American Chemical Society, he states that it has long been known that zinc dissolves in water, and that soft water, such as rain water, dissolves it more easily than hard water. Water containing carbonic acid is specially able to dissolve it. The use of galvanized iron for pipes and tanks being so much on the increase, the subject becomes more and more important, and it is desirable to ascertain, as far as possible, to what extent solution of the zinc coating takes place, and how far water contaminated by zinc is injurious to health. The author quotes several investigators as to the latter point, the evidence being to some extent conflicting, but giving a very decided balance on the side of the view that such water is considerably injurious. Investigations made on behalf of the French Government resulted in the prohibition by the Ministry of Marine of the use of galvanized iron tanks on board men-of-war. Professor Heaton has given an analysis of a spring water, with a further analysis of the same water after it had traveled through half a mile of galvanized iron pipe. It had taken up 6.41 grains of zinc carbonate per gallon. Dr. Venable gives the results of an observation of his own, where spring water passed through 200 yards of galvanized iron pipes to a house, and took up 4.29 grains of zinc carbonate per gallon. It therefore seems pretty clear that drinking water should not be allowed to come in contact with zinc.

FROM "THE METAL WORKER," DECEMBER 19TH, 1885.

THE BOWER-BARFF PROCESS.—Some time ago we published a description of the Bower-Barff process of protecting iron, and briefly pointed out its merits. In a recent number of London *Engineering* we find the following account of the process, which contains some additional particulars that may prove of interest to our readers:

The Bower-Barff process for protecting iron from rust, by covering it with a skin of magnetic oxide of iron, appears to be steadily gaining in favor in Germany. It is not infrequently mentioned in German technical journals, and always with approval. Recently, at a meeting of a branch of the German Engineers' Society, at Hanover, a paper was read by one of the members, in which he very strongly recommended the process to engineers and architects. Speaking of the fine blue-gray color of the coating formed, he said that this was always the more beautiful, the cleaner the surface of the articles operated upon. The coating adheres very strongly to the metal, but still not so strongly as to allow of working iron so coated beyond a very limited extent. Thus, wire cannot be bent without cracking off the oxide formed on it. Therefore, all articles to be protected should be finished before the oxidation takes place. As regards the strength of iron treated by the process, the results of experiments go to prove that wrought iron does not in any way suffer by the oxidation, and that cast iron gains in strength, inasmuch as the outer surface is to a considerable extent changed, and made like malleable cast iron, gaining in toughness. The protection is very perfect, as has been proved by burying test pieces for one year in the ground in very damp and unfavorable places. The coating is liable to have its appearance injured by handling, and for objects where this is a matter of importance it is better to brush the surface over with grease or wax, which is absorbed into the oxide and remains in it, permanently protecting it. Another property of objects coated with the oxide is specially pointed out, as of great value for some purposes, especially for objects of art. The oxide coat easily takes enameling, silvering, gilding or platinizing.

FROM "THE METAL WORKER," JANUARY 23D, 1886.

J. C. Baylis, Esq., *Editor.*

BOWER-BARFFED IRON PIPE.—Mr. Wm T. Wells, 7 and 9 Cliff Street, New York, is making a specialty of Bower-Barffed iron pipe for water conveyance, and is selling large quantities. Rustless iron pipe, in 14-foot lengths, which can be put together by the ordinary threaded couplings, meets a great want, especially in districts where the life of lead and tin pipes is short, and for uses which do not permit the discoloration of water by iron rust. The Editor of THE METAL WORKER piped his residence with Bower-Barffed iron pipe in 1881, and since that time has had absolute immunity from trouble of any kind. The drip of basin cocks on white marble slabs fails to show a trace of rust discoloration, and tests for iron give no reaction. So far as we know, these were the first pipes of this kind used in this country, and we are satisfied from personal experience that they are the only kind of pipes which can be recommended for water conveyance under all circumstances. As soon as their advantages are thoroughly understood the demand for them wil increase rapidly. Treatment adds about one cent per pound to the cost of the iron pipe, and we have no reason to suppose that the protecting surface of magnetic oxide will not last without limit. The process is applicable to all kinds of iron work, cast or wrought.

From SPRINGDALE FARM COMPANY.

Murray Hill, N. J., January 6th, 1886.

MR. WM. T. WELLS,

Dear Sir:—I can express perfect satisfaction in your pipe which you furnished us for our creamery. It is so far superior to the common pipe, that we shall use extensively the coming season.

Very truly yours,

H. EDGAR MASON, General Manager.

From D. CUMMINS, Esq.,

Packer of "Lake Shore" Brand of Canned Goods.

Conneaut, Ohio, January 7th, 1886.

MR. WM. T. WELLS,

Dear Sir:—Yours of the 5th received. In reply would say: We placed the "Rustless" pipe you shipped us in July immediately in use, and so far no rust has made its appearance in the water pumped through it. It occupies the worst place on my premises for pipe to rust, as we use the water that comes through this pipe but very little. Common pipe we found it impossible to use in this place. Our water here is very soft, and acts very quick on common iron pipe.

If your process will stand the test of time, which it now looks as though it would, and does not very greatly increase the cost, it must prove a very valuable invention.

Yours, etc.,

D. CUMMINS.

From the MIDDLEBOROUGH WATER WORKS.

Middleborough, Mass., January 8th, 1886.

MR. WILLIAM T. WELLS,

Dear Sir:—Yours of the 5th instant at hand. In regard to "Rustless" iron pipe made by you, would say that I have used it for nine months in conveying water from my well to kitchen, and it has proved entirely satisfactory, giving not the slightest trace of rust in the water. This is especially commendable, as in a well ten rods away enameled iron has become so rusty in one year as to spoil the water passing through it, leaving a sediment of rust in all vessels in which it was allowed to stand, and the galvanizing from the galvanized pipe has been wholly destroyed in a short time, leaving the iron in a condition offensive to sight, taste and smell. Lead pipe is also perceptibly affected by the water in our wells. This pipe is being largely used, and with good satisfaction, in the houses now introducing water from our Town Water Works, which are just being completed.

Yours truly,

W. H. SOUTHWORTH, Water Commissioner.

From THE DURHAM HOUSE DRAINAGE COMPANY.

New York, February 20th, 1886.

MR. WILLIAM T. WELLS,

Dear Sir:—We have been using wrought iron pipe treated by the Bower-Barff process in our work for six months past, with great satisfaction.

It meets perfectly the present demand for a rustless pipe which can be exposed in a building and painted or bronzed. We have used large quantities of "Rustless" pipe for leaders, drains, and soil-pipes in the New York (Astor) Cancer Hospital, where every pipe had to be placed outside of the plastering and bronzed; and also in the De Vinne press (Century Magazine) building, and have every reason to be pleased with results.

We find that the architects are ready to accept the Bower-Barff process as a guarantee against oxidation, and this removes the only objection to the use of wrought iron pipe for the purpose of house drainage.

Very truly yours,

C. W. DURHAM,
President and Gen. Man.

Custom Work Department.

Special attention given to treating all kinds of Iron Work, prices for which will be given upon application.

We have treated a very large variety of Decorative, Architectural and other Iron Work, which has given the greatest satisfaction.

The process has been found specially desirable for very fine *leaf* and *flower* work, made from Wrought Iron, and which would be destroyed by rust.

Having had so much experience in treating all kinds of work, we can treat the most delicate without warping or injuring it.

In designing work to be made "Rustless," it is best to allow for a small permanent expansion. (See article 5, page 4.)

Special care should be observed in riveting bars or bands of iron together, which are of unequal thickness.

From EDWIN A. JACKSON & BRO.

New York, February 24th, 1886.

MR. WM. T. WELLS,

Dear Sir:—We have for some time been using with great satisfaction, as one of the styles of finish of our Grates, that produced by the "Rustless" or "Bower-Barff" treatment of the iron. When properly done, as we have invariably found that you have done the work, this process produces not only a very pleasing effect, but a surface finish that is unchangeable under any exposure to which our work is subject.

We are, very truly yours, etc.,

EDWIN A. JACKSON & BRO.

P. S.—The qualification, "When properly done," used above, may be explained by the statement that two other parties, one in Brooklyn and one in Philadelphia, who undertook to do similar work of ours, made a complete failure of it.

"RUSTLESS" HOLLOW WARE.

REMARKS.

ENAMELED WARE is *EXPENSIVE*, and is not durable, the coating soon flaking off and leaving the iron surface exposed.

TINNED WARE is also *EXPENSIVE*, and the coating soon melts off and leaves the surface exposed to rust.

GALVANIZED WARE is not wholesome, as the Oxide of Zinc which forms on it is a rank POISON, and the coating is not permanent, as hot water will soon dissolve and flake it off.

"RUSTLESS" HOLLOW WARE is superior to all of these for the following reasons:

1st. It is almost as *cheap* as common Iron Hollow Ware.

2d. It is *absolutely free* from poison.

3d. It will not easily flake or chip off.

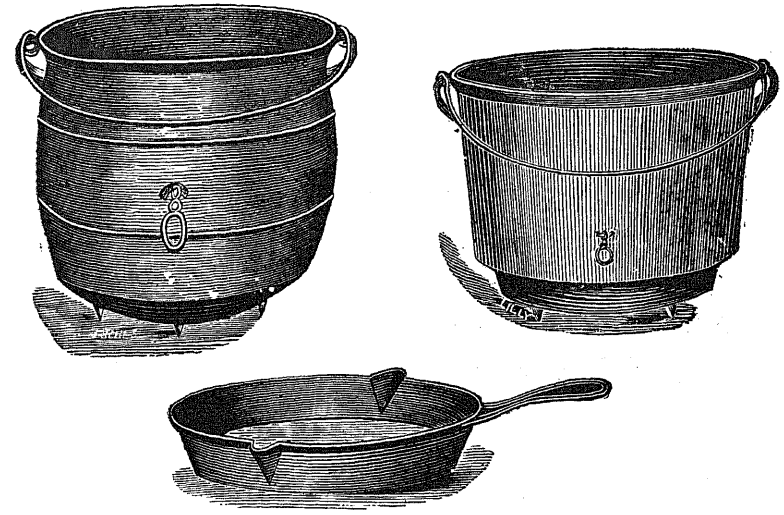
4th. Heat will not melt it or crack it.

5th. If, by any chance, any part of the coating is removed from the iron, and the spot rust, the rust will be strictly local; it will not spread sideways as it would on Galvanized or Enameled Ware.

6th. It is as clean as Glazed Earthen Ware.

7th. It is "RUSTLESS."

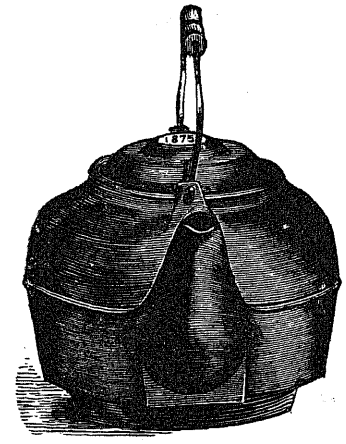
"RUSTLESS" STOVE HOLLOW WARE.



Round or Pit Bottom, with Side Bail.

	6	7	8	9	10
Pots	$ .65	$ .75	$ .85	$1.00	$1.25
Kettles	.55	.65	.70	.85	1.00
Spiders	.27	.30	.35	.40	.50
Per Set	1.47	1.70	1.90	2.25	2.75

"RUSTLESS" SWING COVER TEA KETTLES.

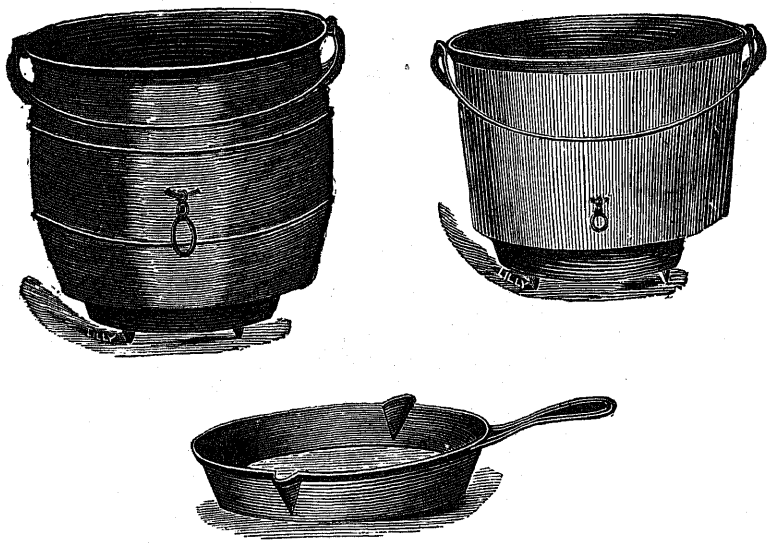


Pit or Flat Bottom.

6 inch	$ .75	6x7 inch	$ .80
7 "	.80	7x8 "	.90
8 "	.90	8x9 "	1.00
9 "	1.00		

All our Tea Kettles have SAFETY FRONTS.

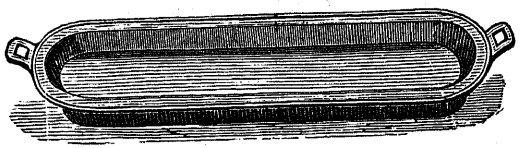
"RUSTLESS" LARGE ECCENTRIC STOVE HOLLOW WARE



Round or Pit Bottom.

	6x7	7x8	8x9	9x10	10x11
Pots	$ .75	$ .85	$1.00	$1.25	$1.75
Kettles	.65	.70	.85	1.00	1.40
Spiders	.30	.35	.40	.50	.60
Per Set	1.70	1.90	2.25	2.75	3.75

"RUSTLESS" DEEP GRIDDLES OR FISH PANS.



No. 6	$ .45	No. 8	$ .60
" 7	.50	" 9	.75

"RUSTLESS" LONG STOVE GRIDDLES.

6	7	8	9
$ .45	50	.60	.75

"RUSTLESS" HANDLED GRIDDLES.

6	7	8	9
$ .22	.25	.27	.30

"RUSTLESS" ROUND GRIDDLES, WITH BAILS.

10	12	14	16
$ .40	.50	.65	.80

"RUSTLESS" SCOTCH BOWLS.

1	2	3	4	5	6
$ .35	.40	.45	.50	.60	.70

"RUSTLESS" YANKEE BOWLS.

1	2	3	4	5	6
$ .35	.45	.55	65	.75	.90

"RUSTLESS" HAM BOILERS.

6	7	8	9
$1.40	1.90	2.25	2.50

"RUSTLESS" CAST OVEN PANS.

1	2	3	4	5	6
$ .45	.50	60	.75	.95	1.35

"RUSTLESS" REVOLVING WAFFLE IRONS.

	6x7	7x8	8x9	9x10
Patent	$ .90	1.05	1.20	1.30
Pl	.60	.75	.90	1.00

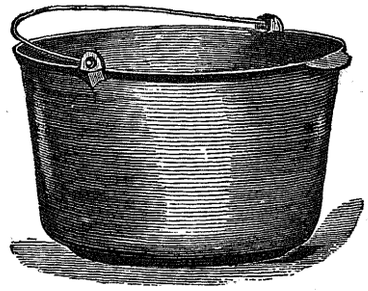
CAST IRON CHARCOAL FURNACE.—THE BEST IN USE.

This Furnace will stand without injury any kind of weather.

1	2	3	4
$ .65	.90	1.10	1.40

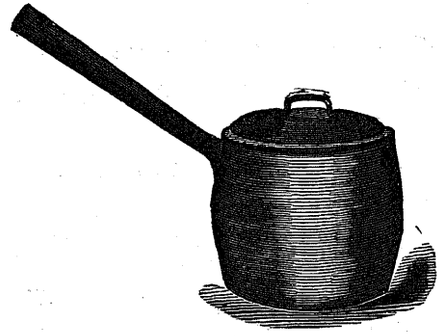
"RUSTLESS" IRON STOVE RESERVOIRS.

"RUSTLESS" MASLIN KETTLES.



Quarts,	2	3	4	5	6	7	8	9	10	12	14	16	20	24
Each,	$ .45	.60	.75	.90	1.10	1.20	1.30	1.35	1.40	1.50	1.75	2.00	2.50	3.00

"RUSTLESS" FLAT-BOTTOM ROUND BOILERS AND BELLIED SAUCEPANS.



Pints,	1	1½	2	3	Quarts,	2	2½	3	4
Each,	$ .39	.44	.48	.56	Each,	.63	.68	73	.84

Quarts,	5	6	7	Gallons,	2	2½	3	3½	4
Each,	$ .96	1.11	1.21	Each,	$1.31	1.56	1.70	1.85	2.00

"RUSTLESS" GLUE POTS.

Nos.	000	00	0	1	2	3	4	5	6
Per doz.,	$5.00	5.50	6.00	6.75	8.40	10.26	12.42	14.58	16.94

TESTIMONIALS.

From "THE METAL WORKER," September 6th, 1884.

William T. Wells, extensively engaged in the Hollow Ware business, at 7 and 9 Cliff Street, New York, with works at Little Ferry, N. J., where he has a Bower-Barff furnace, is having excellent success in the introduction of "Rustless" Hollow Ware. It having been a question whether the coating of magnetic oxide would resist vegetable acid, Mr. Wells tried the experiment of boiling lemon juice and water, which was effected without any influence upon the coating. Not deeming this conclusive, he took a saucepan to his house and had made in it a quantity of apple-sauce before it had been used for anything else. A bottle of this sauce, which Mr. Wells sent us, we found upon examination to be absolutely free from any discoloration other than that due to the amber juice of the apple. We feel confident that Bower-Barffed Hollow Ware is the coming furniture for the kitchen.

From Messrs. McFADDEN & DOOLEY, Practical Plumbers, and dealers in Stoves and Ranges.

MR. WM. T. WELLS, New Brunswick, N. J., February 13th, 1886.

Dear Sir:—In regard to "Rustless" Ware, we will say that we have sold it for two years, and sell it in preference to any other kind of Hollow Ware, and it gives perfect satisfaction.

Yours truly,

McFADDEN & DOOLEY.

From Mr. G. D. VOORHIS, Stoves, Ranges and Heating Apparatus.

Paterson, N. J., January 28th, 1886.

MR. WM. T. WELLS,

Dear Sir:—In reply to yours of recent date, would say that we have now used your "Rustless" Hollow Ware for over a year, and find that it gives universal satisfaction to our customers. In fact, we could not now get along without it—as people ask for it and will take no other. We believe that any dealer who has energy and business ability enough to introduce new goods will find that it will pay him well to push the "Rustless" Hollow Ware. We believe that "a pleased customer is our best advertisement," and "Rustless" Ware pleases the ladies as they do not have to clean it.

Yours truly,

G. D. VOORHIS.

MEMORANDA.

PLUMBERS'

"RUSTLESS"

IRON

GOODS.

For Wrought Iron Pipe, See Page 7.

"RUSTLESS"

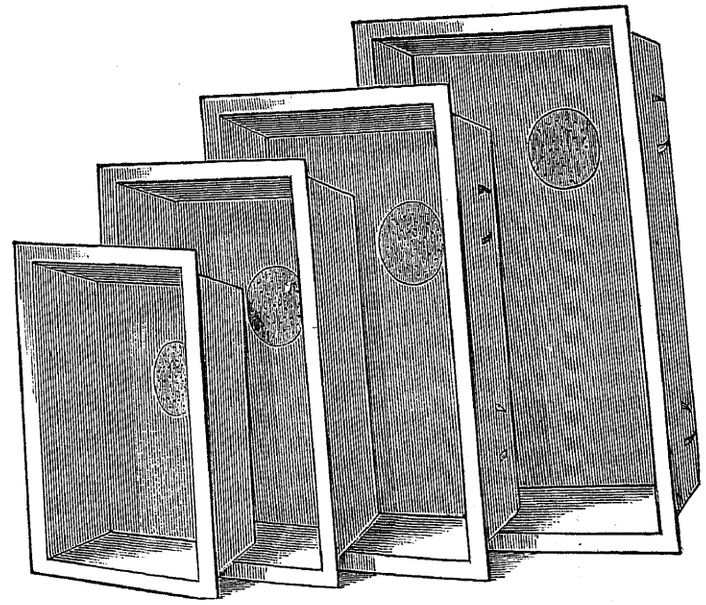
CAST IRON DRAIN PIPE

AND FITTINGS.

	2 inch Diam.	3 inch Diam.	4 inch Diam.	5 inch Diam.	6 inch Diam.
Cast Iron Soil Pipe, per foot	$0.24	$0.30	$0.36	$0.50	$0.60
Double Hub Pipe, per length of 5 feet	1.50	1.80	2.10	2.80	3.30
Quarter Bends	.40	.55	.65	1.00	1.20
Quarter Bends, with 2in. Outlets with connection, 30c.; 3in., 40c., and 4in., 50c. extra.					
Double Hub Quarter Bends	.70	.85	.95	1.30	1.50
Double Hub Eighth Bends	....	....	.90	1.20	....
Sixth Bends	.40	.55	.65	1.00	1.20
Eighth Bends	.35	.45	.60	.90	1.05
Sixteenth Bends	.35	.45	.60	.90	1.05
Return Bends	.65	.85	1.25	2.00	3.00
Long Bends, 18 inches in clear	....	....	1.50	2.25	2.50
T Branches	.40	.55	.65	1.20	1.40
Double Hubs	.30	.45	.65	.75	.80
Single Hubs	.25	.35	.40	.60	.75
Reducers	....	....	.50	.70	.80
Increasers	....	.70	.90	...	1.25

Discount.....per cent,

"RUSTLESS" IRON SINKS.



SQUARE SINKS.

16½ × 12½	5	in. deep	$1 10
18 × 12	6	"	1 25
16 × 16	6	"	1 60
22 × 14	6	"	1 60
23 × 15	6	"	1 70
25½ × 15½	6	"	1 75
20 × 12½	6	"	1 50
20 × 14	6	"	1 50
24 × 14	6	"	1 70
24½ × 16	6	"	1 80
24 × 18	6	"	2 10
25½ × 17½	6	"	2 10
27 × 15	6	"	2 00
24 × 20	6	"	2 40
28 × 17	6	"	2 20
28 × 20	6	"	2 70
30 × 16	6	"	2 25
30 × 18	6	"	2 50
30 × 20	6	"	3 00
32½ × 18	6	in. deep	$3 00
32½ × 21	6	"	3 40
36 × 18	6	"	3 00
36 × 21½	6	"	3 70
38 × 20	6	"	3 80
42 × 22	6	"	4 25
48 × 20	6	"	5 30
48 × 23	6	"	5 75
24 × 14	8	"	2 50
30 × 24	8	"	5 00
50 × 24	6½	"	7 50
50 × 26	6½	"	8 00
62 × 22	8	"	10 75
76 × 22	7	"	15 00
56 × 32	9	"	16 00
60 × 28	10	"	18 00
78 × 28	10	"	25 00
94 × 24	10	"	30 00
120 × 22	6	"	32 00

SHALLOW SINKS.

24 × 15½	4 inches deep	$1 40
30 × 17½	4 "	2 10
36 × 19	4 "	2 60
42 × 20½	4 "	3 40
48 × 22	4 "	4 10

HALF CIRCLE SINKS.

No. 1,	Back, 24 inch,	Width, 14 inch,	Depth, 6 inch	$1 50
2,	" 27 "	" 14 "	" 6 "	1 80
3,	" 28 "	" 16 "	" 8 "	2 50
4,	" 31½ "	" 17 "	" 6 "	2 25

CORNER SINKS.

No. 1,	Side, 17 inch,	Front, 25 inch,	Depth, 4½ inch	$1 25
2,	" 20 "	" 28 "	" 6 "	1 75
3,	" 22 "	" 31 "	" 6½ "	2 10

CORNER SINKS,

With Plain Backs and Patent Overflows.

No. 1,	Side, 17 inch,	Front, 25 inch,	Depth, 4½ inch	$5 00
2,	" 20 "	" 28 "	" 6 "	6 00
3,	" 22 "	" 31 "	" 6½ "	7 00

If without Patent Overflow, deduct $1.00.

CORNER SLOP SINK.

Side, 18½ inch, Front, 25 inch, Depth, 12 inch.....$4 00

SQUARE SLOP SINKS.

16 × 16	10 inches deep	$2 70
20 × 14	12 "	3 50
20 × 16	12 "	4 00
24 × 20	12 "	5 00
23 × 15	15 "	4 25
30 × 20	12 "	8 00
36 × 21	12 "	10 00
36 × 21	16 "	14 00
48 × 20	12 "	17 00
48 × 20	17 "	20 00

If with Patent Overflow, add to above prices of all styles of Sinks, $1.00
If with Plug Strainer, add..... .20

SINK LEGS.

Each.....$0 50

SINK BACKS.

20 inch	$1 25
22 "	1 35
23 "	1 40
24 "	1 50
25½ "	1 60
27 "	1 70
28 "	1 80
30 "	2 00
32½ "	2 25
36 "	2 75
38 "	3 00
42 "	3 50
48 "	4 25

Larger Sizes in sections made to order.

CORNER URINALS.

No. 1,	7 inch on side	$0 75
2,	9 " "	1 00
3,	12 " "	1 25

HALF CIRCLE URINALS.

No. 1,	12 inch on back	$1 00
2,	15 " "	1 30

WASH BASINS,

With Overflow.

12 inch	$1 25
14 "	1 50
15 "	1 75
16 "	2 00

PHILADELPHIA HOPPER.

White Enameled.....$2 00

ALL KINDS OF PLUMBERS' CASTINGS

MADE TO ORDER.

ALL KINDS OF

STABLE FIXTURES

TO ORDER.

MEMORANDA.