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THE GREAT BIRMINGHAM GAS HOLDERS.—[See page 146.]

BIRMINGHAM CORPORATION GAS HOLDERS.

These gas holders, the largest in the world, are made in three sections. The three sections telescope into each other, the lower one being the largest.

The upper section is 230 ft. in diameter. Its sides are 50 ft. high. The crown that covers it in rises 20 ft. in the center, giving a total height of 70 ft. for the section. The main part of its plates are of No. 9 iron, with 1⅛ in. laps, secured by five-sixteenth inch rivets. The crown is untrussed.

The stiffness of the crown of the Birmingham holders is secured, apart from the inherent strength of the ordinary plates as pressed upward by the gas, by the use of a sort of half box girder running around the upper curb. It is composed of two principal members. Around the upper sides of the section, and taking the place of the regular side sheets, a row of vertical steel plates, 14 in. wide, ⅝ in. thick, each about 27 ft. 9 in. long, are carried and secured to each other by butt joints, strapped and double riveted, the straps coming inside the holder. This constitutes one member. The first row of crown sheets are of similar steel, 3 ft. wide, and also butted and strapped, forming the second or horizontal member. A special obtuse angle iron, 6″ × 6″ × ¾″, is carried around the curb, and these two sets of plates are riveted to it, one set on top and one on the side. Then within the holder fifty-two bracket plates, of ½ in. iron, are riveted within the angle. This, it will be seen, represents a circle of a half box girder, 14″ × 36″ × ⅝″, with re-enforcing brackets.

All the butt joints here and throughout the holder are planed so as to fit accurately. The top sheets are arranged in circles with radial joints. The side plates are of No. 10 iron, except the lower two courses, which are ¼ in. in thickness. The arrangements adopted for the roller frames are of much interest.

In the drawing, one of the roller frames is shown in position, secured to the upper curb. It rests on the row of steel plates already described as constituting the horizontal member of the box girder. The double riveting of the butt joint, and the double line of riveting attaching the plates to the angle iron, are also shown. The general construction and bracing needs little description. Three rollers are carried by each frame. One is the radial roller in use in England and America universally. The other two are the French tangential rollers. For guide rail, an H-beam or joist iron is used. The tangential rollers work on the flat surfaces; the radial roller works in one of the channels.

Screws are provided for adjusting the rollers accurately to their work. The radial roller is 2 ft. in diameter; the others, 18 in. There are twenty-six such carriages, or roller frames, on the top curb of each holder.

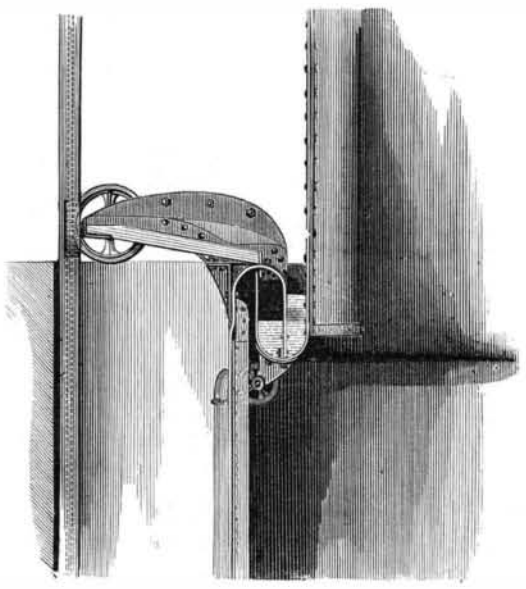
It is calculated that by this combination of rollers the pressure due to wind from any given direction is supported by and divided among three-quarters of the guide rails and columns—a very superior distribution of strength.

At the bottom of the section a cup is formed by bending a seven-sixteenth inch sheet into a U-shape. This is known as Piggot's form, being due to Mr. George Piggot, who introduced it in 1862.

An illustration of the cup of the upper section is given, showing the bottom rollers within the section. The cups are 12 in. wide by 18 in. deep. In this cut is also shown the top of the next or intermediate section as it enters the cup. The bottom rollers of the upper section work in a channel bar secured to the inside of the next lower section, and outside of this section a plate of iron bent into semicircular form is secured that extends up and down the entire height. Each of the sections has fifty-two such "booms" or stiffeners. The ends of two of them are shown in the cut. Those for the upper section are within it; for the other sections they are on the outside. As bent, they are 11 in. wide by 13 deep for the upper section, and 18 in. wide by 4 in. and by 5 in. deep for the intermediate and lower sections respectively. The vertical booms of the two lower sections are re-enforced on the interior of the holder by channel bars, which are riveted by means of angle irons to the interior side walls, and within their grooves the bottom guide rollers travel. The vertical booms of the upper section coming within the interior have no such re-enforcement.

Smaller carriages or roller frames with radial and tangential rollers are attached to the upper curb of each section. Thus there is a total of seventy-eight carriages in each holder. For upper and lower sheets ¼ inch plates were used on both lower and intermediate sections. The rest of the sheets are No. 10 gauge. The bottom curb is an incomplete or three-sided box girder, with two 9 inch horizontal plates connected by a 24 inch channel bar, all nine-sixteenths inch in thickness. The bottom guide rollers work within this space. All the rollers turn on steel pins.

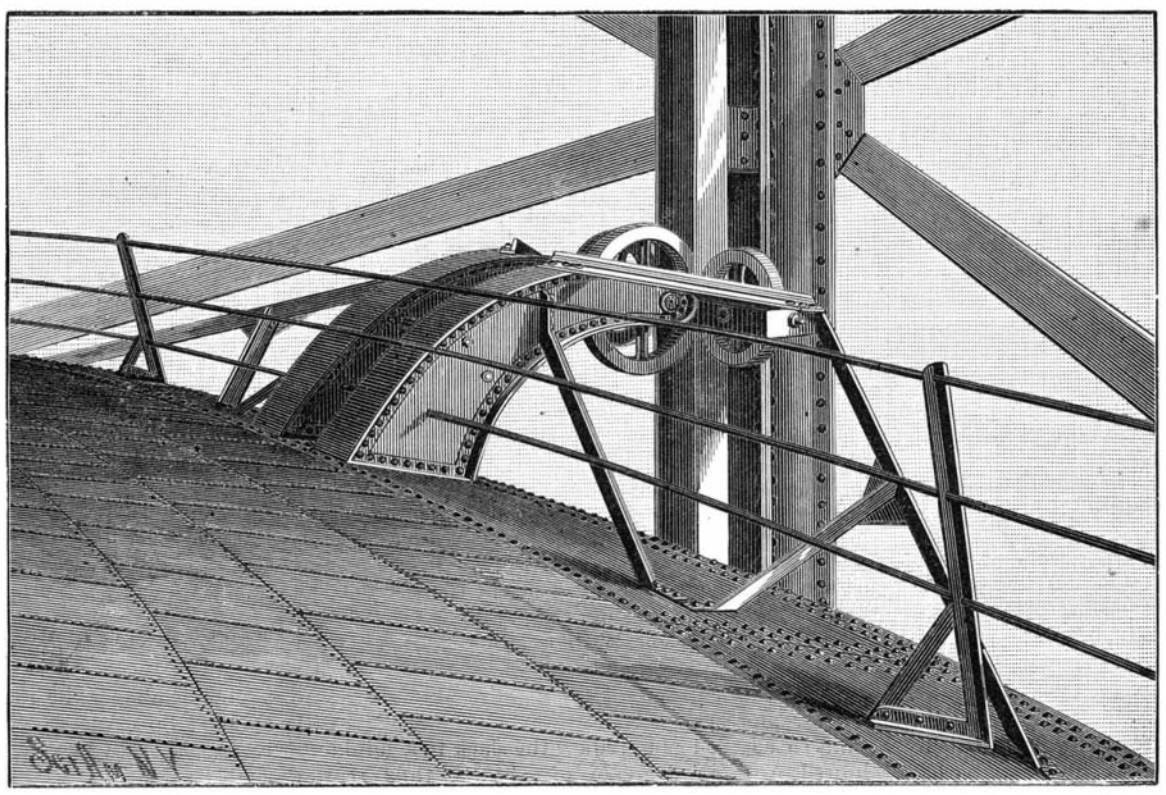
The frame is next to be spoken of. In this we recognize an integral structure, not a mere collection of columns held together by girders from top to top.



ROLLER FRAME AND GUIDE RAIL.

Each frame consists of twenty-six upright members. Each member is composed of three hollow beams, each made up of four flanged segments, that form, when united, a hollow cylinder. They are spaced at the base five feet apart from center to center, and come together at the top. The inner beam is vertical, and carries the H-beam against which the rollers work. The two outer beams slope inward and meet it at the top. This series of three beams, each 12 inches in diameter, is braced and tied by cast iron struts and cross bracing. Each set constitutes a vertical member of the frame.

These series or members are connected by 8 in. × 5 in. H-beams, placed horizontally and crossing each other. A system of cross latticework is carried from top to bottom around the outside of the frame. The bars composing it at the bottom courses are 9 in. by ⅝ in., diminishing to half that width at the top. A six by five inch H-beam is fastened in an accurately perpendicular position to the front column of each group, to act as guide rail for the rollers, as already described.



TELESCOPING CUP BETWEEN UPPER AND INTERMEDIATE SECTIONS.

As the two holders are close together, the frames are connected with each other, for mutual re-enforcement. There are no wind ties at the top of the frame. A protective hand rail runs around the curb of the upper section.

Each of the Birmingham holders is 236 feet in diameter and 150 feet high, with a capacity of 6,500,000 cubic feet. The height to the center of the crown is 177 feet. The inlet pipe is 36 inches in diameter.

The pressure produced by these gigantic structures is 8·3 inches. As iron is of about seven times the specific gravity of water, if all the iron in one holder, exclusive of the frame, were melted into a disk of the diameter of the outer section, it would be about one inch in thickness (more exactly 1·15 inch), and would weigh about 1,000 tons. Including the guide frames, 3,250 tons of iron were used in both the structures. Each one holds about one hundred tons of gas, that exerts about the same lifting power, in virtue of its buoyancy.

Comparing one of these holders with the Great Eastern, it will be found to have about double the capacity of the including parallelopipedon of the great vessel. The holding capacity, if calculated in cubic feet of water, is about four times the displacement of the vessel, or 100,000 tons. Including a water surface 236 feet in diameter, and a clear height of over 150 feet, it will be seen that a large vessel could be comfortably docked within it.

Influence of Light on Colors.

Dr. John Percy says:

"I have drawings made by myself about fifty-seven years ago, in which the gray was made of indigo and Indian red. They have been kept in the dark ever since, and, so far as I can observe, no change has taken place. On the other hand, I have seen hundreds of drawings in which the grays used were the same, but from which the indigo has wholly disappeared in consequence of long continued exposure to solar light. It would not be difficult to make a large exhibition of faded drawings of such men, for example, as Francis Nicholson, Copley Fielding, and De Wint. This subject of the durability of pigments with reference to water color drawing has engaged my special attention for more than twenty years, and some day, perhaps, I may communicate the results even at the risk of exciting the ire of some persons. Certain colors resist light, and others do not. My collection contains about 1,600 drawings, almost wholly of the early English school, and the work of about 700 different artists, so that I can speak with some experience on the subject. Facts as to the durability or non-durability of water color drawings are abundant and amply sufficient to settle the question. But in order to explain the chemical changes induced by light, long and very accurate investigation will be required by men thoroughly competent for the work.

"I will mention one curious circumstance, not so generally known, I think, as it deserves. It is imagined by some persons that in a hard, solid, compact substance, such as glass, chemical change under ordinary atmospheric conditions cannot occur. Now, you have probably noticed, many years ago, the pink color of many windows in London. That color was actually developed by the action of light upon the glass. Faraday, if I mistake not, first pointed out that where the glass had been protected from light by putty, it remained colorless as at first. Oxide of manganese is used in the manufacture of window and some other kinds of glass to counteract the color which would be produced by the ferrous oxide, which is always accidentally present in small proportion in the materials from which the glass is made.

"Is it not strange that the pink color should result from the action of the light on the manganese compound in the glass? The manganese passes in consequence to a higher degree of oxidation, in which state it is pink or purple. If you take, as I have done, a piece of the window glass colored pink, and heat it gently, it loses its color and becomes quite colorless, as it was at first. Thus we see that even in such a substance as glass, chemical intermolecular movement may occur. If this be so, then we may expect a similar result in resins, of which varnishes are made."

HOW TO TIN CLOTH.—A mixture of finely pulverized metallic zinc and albumen, of about the consistency of a thin paste, is spread with a brush upon linen or cotton cloth, and by means of hot steam coagulated. The cloth is now immersed in a bath of stannic chloride, well washed, and dried. Running the cloth through a roller press, the tin film is said to take metallic luster. Designs cut in stout paper, letters, numbers, etc., when laid between cloth and roller, are impressed upon it. It can also be cut in strips, corners, etc.

How Bohemian Glass is Colored.

The ornamentation of the glass is done partly in connection with the exposure in the furnace and partly in the finishing shops, where the work is completed by cutting, polishing, tarnishing, etching, painting, and mounting in metal. The glasshouses have at their command a very complete color scale for transparent, opaque, and clouded glasses. But it must not be supposed that a crucible is placed in the furnace for each color, from which glass colored for each ornament is to be made. The colors are worked out by means of what are called pastes, which are kept on hand in sticks or cakes. From pieces of these pastes, previously warmed till they are soft, suitable quantities are cut off, laid upon the foundation of white or colored glass, and then spread out by drawing or blowing. By this means only is an economical use of such costly materials as gold and silver compositions possible. Some of the glasses thus treated—gold, copper, and silver glasses—remain still little, or not at all, colored after the melting, shaping, and quick cooling, and do not take on their bright hues until they are reheated. This is the case with the new yellow silver glass, which continues uncolored after the intermelting of the silver salt until it is exposed in the furnace again. Very fine effects are produced by blending or overrunning of paste colors, provided proper attention is given to the laws of harmony. A blue glass cup is, for example, overlaid with silver glass at its upper edge, and this is drawn down in gradually thinner tones till it fades away at the foot of the vase. Gold and copper ruby colors are thus combined with green glasses, etc. Another brilliant effect is produced when a still hot bulb of glass is rolled in finely pulverized aventurine glass, and after this is melted, and previous to the shaping of the vessel, is overlaid with a coating of either colored or colorless glass.—*Popular Science Monthly.*

Wanted, a Gas Meter.

The following inquiry has been addressed to the editor of this paper, which question we refer to our mechanical and inventive readers for an answer:

"Can any of your mechanical correspondents refer us to a self-acting meter for the registry of gas, as manufactured?

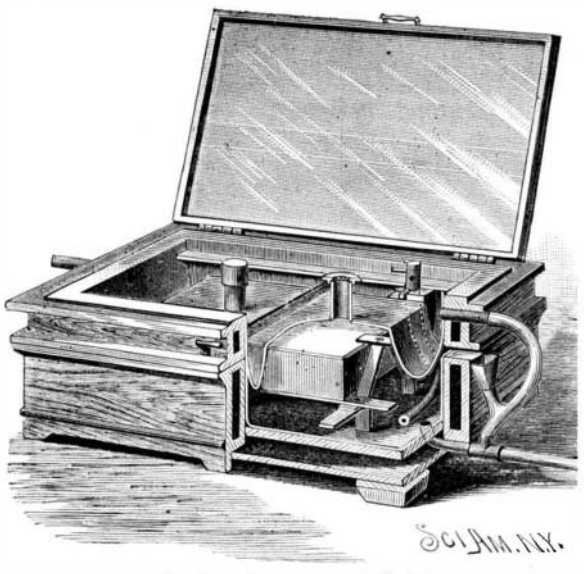
"They are needed to be used in connection with exhaust fans, and the gas will have a temperature of between 400° and 500°. They should be able to run at least 30 days, and 90 days would be preferable.

"The gas, an oxyhydrocarbon one, available at will for heating, power, and illuminating purposes, will be largely used in manufactories and other works, and it is for the determination of the gross amount of royalty to be paid that they are required."

The difficulty involved in supplying this want lies in the high temperature of the gas. Ordinary gas meters, if of the wet type, would be quite unavailable, on account of the presence of water and consequent generation of steam. Dry meters would have their diaphragms dried, their oiling destroyed, and their flexibility interfered with. A positive-acting meter, such as used for water, would, if of sufficient capacity, and if the lubrication was not interfered with by the heat, be very expensive. Something of the anemometer type seems to be indicated, as the doctors say. We leave the problem to our readers.

A MILK COOLER THAT EXCLUDES THE AIR.

The illustration herewith shows a cooler designed to facilitate the changing of the milk and the raising of the cream without uncovering the pans to the outside air and dust. The lower part, or pan box, of the cooler



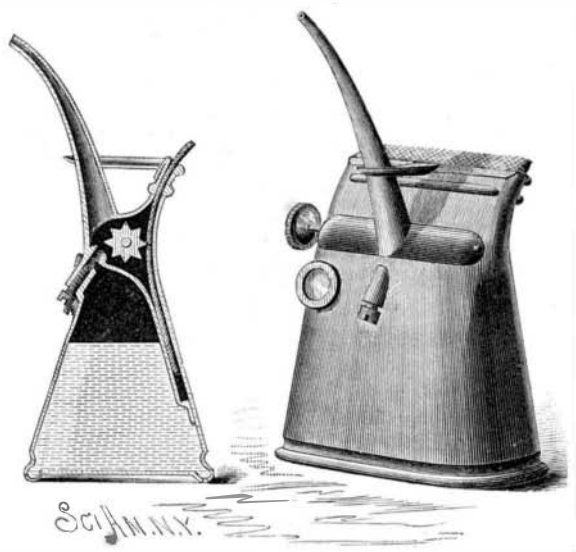
BRAMKAMP'S MILK COOLER.

is made with double bottom and side walls, providing air spaces, as will be readily understood from the engraving, where one corner of the cooler is shown with parts broken away. The cream pans, which are shallow, are supported with their tops about level with the top of the box, upon a metal framework, attached to the bottom and sides of a sheet metal lining. The box has an overflow pipe and a lower outlet pipe, through which the water used in cooling the milk may escape. The cover of the box has an interior water tight sheet metal lining, the central portion of which is raised, forming a pendent trough-shaped part, which enters the box around the milk or cream pans, and water-seals the pans against the entrance of air when the cooler is in use. In the lining, over each of the pans, is fitted a tube, through which the milk may be passed or strained into the pans. The water supply pipe is fitted at one end of the cover, and the overflow and discharge pipes at the opposite end. The water circulation may be regulated as desired, and the pans may be filled without lifting the cover.

This invention has been patented by Mr. John H. Bramkamp, of No. 825 Holiday Street, Denver, Col.

AN OIL CAN WITH WICK TUBE BESIDES A NOZZLE.

The accompanying figures represent an oil can having a body of oblong form, provided with spring sides, and terminating in a wick tube for receiving a broad wick for applying oil to the surface of saws, for the purpose of lubrication, and for oiling metallic surfaces to prevent rust. This oiler has also a nozzle or spout, with a regulating valve for controlling the amount of oil escaping through the nozzle or the wick. By the side of the wick tube is formed a chamber containing spur wheels placed on a spindle, extending longitudinally through the chamber and through the end of the can, the spur wheels engaging the wick, so that by turning the spindle the wick may be raised or lowered.



MOAT'S OILER.

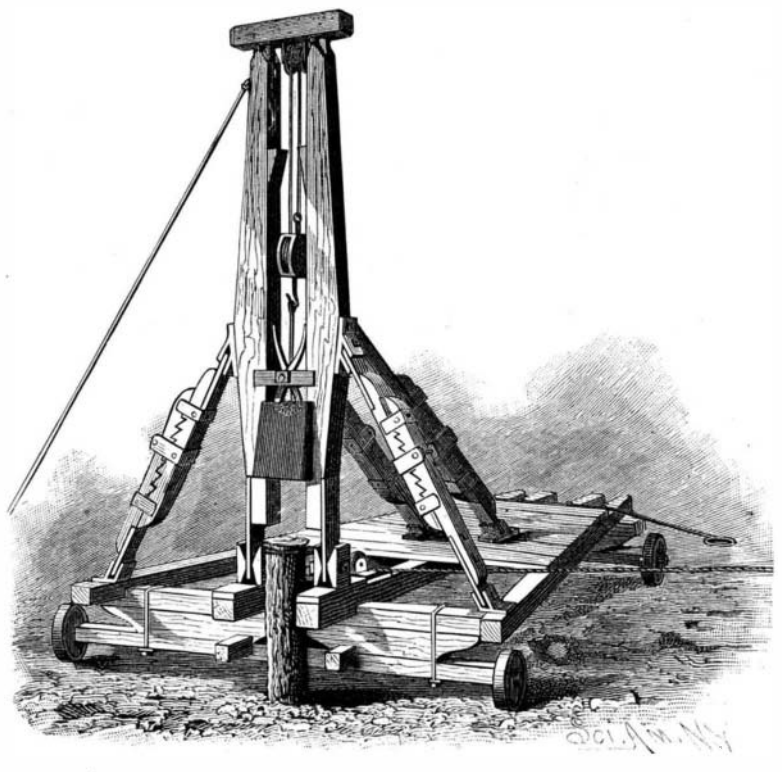
This invention has been patented by Mr. Elijah Moat, corner of Third and Flower Streets, Los Angeles, Cal.

A TRAVELING POST AND PILE DRIVER.

In this construction the derrick is so mounted upon the vehicle platform that it may always be adjusted to a perpendicular position, irrespective of the contour of the ground on which the vehicle stands, while the arrangement is such that the derrick may be folded down to rest in a horizontal position, and a tongue or bolt connected to either axle of the vehicle.

The rear axle of the vehicle is much longer than the forward axle, both axles having pole couplings, and both being connected to the platform framework by king bolts. The derrick proper consists of two timbers, to the lower ends of which are secured stout iron legs, which rest in sleeves secured to the upper faces of the rearwardly extending ends of the central timbers, in such way that the derrick timbers may be tilted, upon their connection with the vehicle platform, either to one side or the other, or folded backward, while they may be supported by braces in a vertical position. The braces are each formed in two sections, each section carrying blocks arranged so that their teeth will interlock, and there is a binding pin which holds the teeth in engagement, but which may be withdrawn in order that the length of the brace may be adjusted to suit the requirements of any particular case. Between the guide timbers is the weight to be used as a hammer, with the ordinary form of hoisting and tripping mechanism. A long pole is so connected, near the top, to one of the vertical timbers that it may be carried to the side, front, or rear of the derrick, to aid the operator in moving it, irrespective of his position.

This machine has been patented by Mr. Adam Towberman, of Sutherland, Iowa.



TOWBERMAN'S POST AND PILE DRIVER.

Thunder Storms.

From certain meteorological statistics recently published in Germany, we learn that thunder storms in that country have, during the last thirty years, been steadily increasing both in frequency and severity. The number of deaths per annum from lightning has increased in a far greater ratio than that of the increase of population. In the present state of our knowledge of the whole subject of atmospheric electricity, the cause of the phenomena of thunder storms is confessedly obscure. It is, however, very possible that some light would be thrown upon the question by a comparative study of the frequency and severity of storms during a lengthened period and over a wide geographical area.

The German *savants* incline to the opinion that the increase is to be attributed to the enormously increased production of smoke and steam which has taken place during the last three decades. But although we may admit this to be to some extent a probable *vera causa*, yet, when we consider the very local character of thunder storms, we should naturally expect to find that it would follow that the neighborhoods of large cities, and especially of manufacturing districts, would suffer the most severely. But the statistics referred to show distinctly that the very reverse is the case. The number of storms attended by fatal results from lightning is far larger in the agricultural districts than in the towns. Upon the other hand, we ought to take into consideration the protective action of lightning conductors, with which the prominent buildings in the towns of Germany are well provided.

Artesian Wells in Denver.

In 1883 the president of the Denver Water Company, one of the owners of landed estate in North Denver, on the highlands, just across Platte River, immediately opposite the business section of the city, conceiving his land to be underlaid at considerable depth with valuable coals, began boring them. At a depth of about 300 feet a stream of water was suddenly projected, with great force, from the bottom to a height thirty or forty feet above the surface, completely drenching his men and compelling a suspension of work. At first it was thought to be but temporary; but as it continued day after day without any perceptible decrease of force or volume, and as the theory of its projection from true artesian sources, so to speak, became more and more apparent, Mr. Zang, owner of a large brewery near by, concluded to test the matter for himself. In due time, apparently, the same deposit was encountered at a depth of 300 feet, and then followed a succession of like enterprises, all of which were successful. Many wells are now in operation, varying in depth from 250 to something over 700 feet, the deepest being that sunk by the county of Arapahoe, near its splendid court house, which is 910 feet deep, the whole producing about 3,000,000 gallons per day of 24 hours. The water is very pure and fine.

Stannous Chloride as a Disinfectant.

This is recommended by Dr. Abbot as being more active than zinc chloride, copper sulphate, zinc sulphate, or ferric sulphate, spores being killed after exposure to one per cent solution for two hours. It is cheap, tolerably safe, and will not corrode lead pipes. It is advised, when required to be kept, and to prevent formation of insoluble oxychloride, to mix it with an equal quantity of ammonium chloride.