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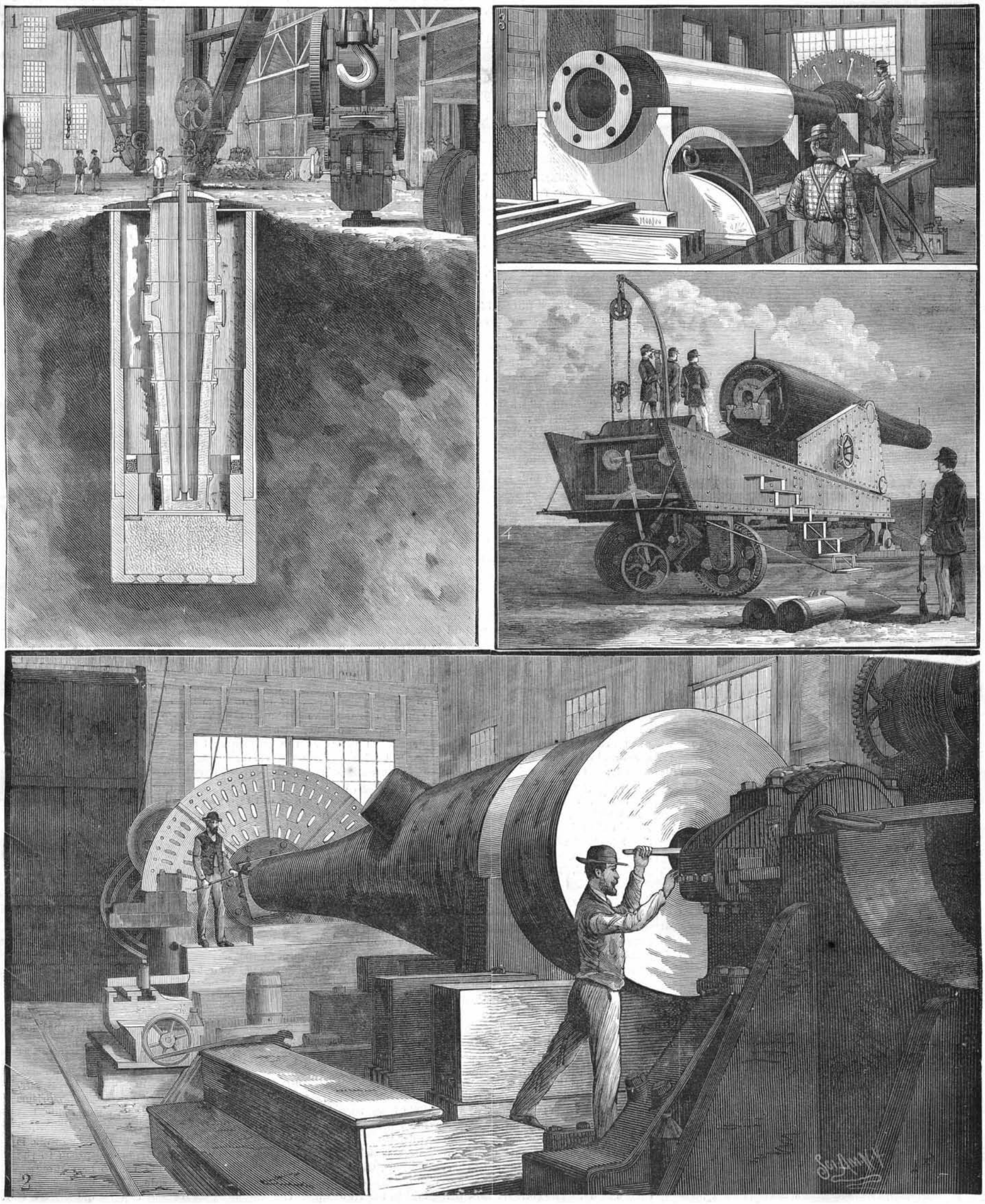

1. INTERIOR VIEW OF ORDNANCE FOUNDRY, SHOWING PIT IN SECTION. 2. BORING OF 54 TON RIFLE. 3. TURNING 53 TON RIFLE. 4. 12 INCH B. L. RIFLE MOUNTED ON SIEGE CARRIAGE.

THE FABRICATION OF HEAVY ORDNANCE AT THE SOUTH BOSTON IRON WORKS.—[See page 197.]

MAKING MAMMOTH GUNS.

To the casual observer, an immense gun is nothing more than a bored mass of iron or steel provided with suitable loading and firing devices, and mounted upon a carriage. But the study of the history of the gun shows that at every step in its manufacture great skill and exceeding care were exercised, and colossal machinery, working with exquisite precision, was employed. From the first process, the making of the pit and mould, to the final finishing, a misstep is liable to destroy all the work, and therefore long experience and the highest skill are necessary to insure perfection. In the following article we have endeavored to plainly describe the various operations in making a mammoth gun, from the pit to the carriage.

The South Boston Iron Works has manufactured ordnance and war material for the United States Government for upward of fifty years, and during the rebellion worked night and day to keep up its supply for the war.

We publish four engravings showing ordnance machinery and the guns in process of construction, and one view of the 54 ton B. L. rifle, mounted on a pneumatic siege carriage at the ordnance proving grounds.

No. 1 is an interior view of the large ordnance foundry, where the 54 ton guns are cast, the ground being broken away so as to show a section of the pit, which is placed in the center of the foundry. On the right are two 40 ton reverberatory furnaces for melting the iron for the casting, and another 40 ton furnace is on the left of the pit, but is not shown in the engraving. The combined capacity of these monster furnaces is 125 tons. A trough or runner leads from each furnace to a pool or basin placed at the mouth of the pit, and from which a short runner conveys the molten iron to the mould.

The pit is 40 ft. deep by 13 ft. in diameter, and its brick walls are 1 ft. thick. In the center of the pit stands the gun flask, which rests on dry sand supported upon a firm foundation of masonry and concrete. Every precaution is taken to prevent the entrance of water within the pit, since even an extremely small quantity would ruin the work. The flasks are flanged sections of iron, which, when placed in position in the pit, form a shell for supporting the mould. The flasks are rammed, washed, and dried before being lowered into the pit, and are not touched after being placed in position.

These flasks, being called upon to sustain a quantity of melted iron weighing from 125 to 150 tons, and to resist a pressure due to nearly 40 feet, are necessarily made of great strength. When casting on July 9, 1884, the flasks broke and the iron flowed into and filled the bottom of the pit. The "cheese" thus formed was 7½ ft. high, 11 ft. in diameter, and weighed 137 tons. It was three months' work to remove this from the pit, and it was wedged so firmly that it required a force of 736 tons to start it from the bottom. The print of the brick lining of the pit is shown so plainly on its outer face as to appear, to an inexperienced observer, like a section of a brick tower.

The upper end of the core arbor is supported by a cast iron tripod or spider, resting upon the upper edge of the top flask. The lower end of the core arbor is steadied by a chaplet which is on the muzzle of the gun casting and beyond the end of the finished gun. Through the center of the arbor passes a pipe, which terminates near the lower end of the arbor. Water flows through this pipe and up the arbor to an outlet pipe at the top. The water is kept running at the rate of forty gallons per minute, both before and during the casting and for two days after, thereby gradually cooling the interior of the casting; the layer of metal next the core is first cooled and solidified, next the succeeding layer in cooling shrinks and binds upon the first, and so on throughout the mass, the exterior being the last to acquire a set.

There are three heavy cranes in this foundry, having each a lifting power of 30 tons. They are used principally for lowering the gun flasks into the pit and removing them after the gun has been cast. The gun is hoisted from the pit by hydraulic power or by a system of lifting screw jacks, both contrivances having been used. After the gun has been lifted from the pit, it is moved into the ordnance machine shops on rolls, much after the manner of moving a house.

Engraving No. 2 is an interior view of the ordnance machine shop, showing one of the 54 ton rifles in the process of being bored in one of the 100 ton lathes. This gun is to have a short steel tube, four inches thick, inserted from the breech and extending a little forward of the trunnions. This tube is shrunk into the bore of the gun, the latter being heated. The longitudinal sectional views, Fig. 5, show this tube and its length and relative thickness. The diameter of the bore of this gun is 12 inches and its total length 30 feet. It will be fired with a powder charge of 265 lb. of brown cocoa powder, and will throw an 800 lb. shot 10 miles.

The third engraving shows another 100 ton lathe in the machine shop, with a 53 ton rifle in the stage of being turned. This gun has a cast iron body weighing about 31 tons. A steel tube, 4 inches thick and of six tons weight (made by Sir Joseph Whitworth, of England), is shrunk into the bore from the rear, and extends into the gun for 168 inches. Two layers of steel hoops of an average width of eleven inches and a thickness of four inches, 26 in number, and about 40 inches in diameter, are shrunk on to the outside of the cast iron body. The hoops (shown in the upper view, Fig. 5) are bored four hundredths of an inch smaller than the outside diameter of the cast iron body, and are expanded by gas burners until they are two hundredths of an inch larger than the body, and are then pushed up to place. Then a stream of water is played on to the hot ring until it cools. The ring then hugs the cast iron, and strengthens it. While the ring is "setting," a hundred ton jack keeps it in position and close up to the preceding ring, so that there shall not be any space at the joint between any two rings exceeding three thousandths of an inch. The diameter of the body of this gun, when ready for the shrinking on of the hoops, showed no variation over two thousandths of an inch, and the ordnance officers consider it the finest and most accurate shrinking ever done in this country or abroad.

This gun will fire the same charges as the 54 ton rifle. The diameter of the bore is the same (12 inches), but it is two feet shorter. The gun, when finished, is about five feet in diameter.

The 12 inch B. L. rifle is shown in the fourth engraving. This is all gun iron, that is, it has no steel tubes or hoops, is rifled with twist one turn in 135 calibers at origin to one turn in 40 calibers at muzzle, and is mounted on a Powlett pneumatic siege carriage at the U. S. ordnance proving grounds at Sandy Hook, N. J. This rifle was mounted in June, 1885, and has been fired 137 rounds with charges of 265 pounds of powder and an 800 pound projectile. This is the best record known in this or foreign countries for a 12 inch rifle, with this weight of powder and projectile. A 12 inch B. L. steel rifle, made by Herr Krupp, has been fired 120 rounds. The muzzle velocity of the 12 inch gun iron rifle is 1,862 feet per second; penetration at 1,000 yards, 23 inches of armor; and range, 10 miles.

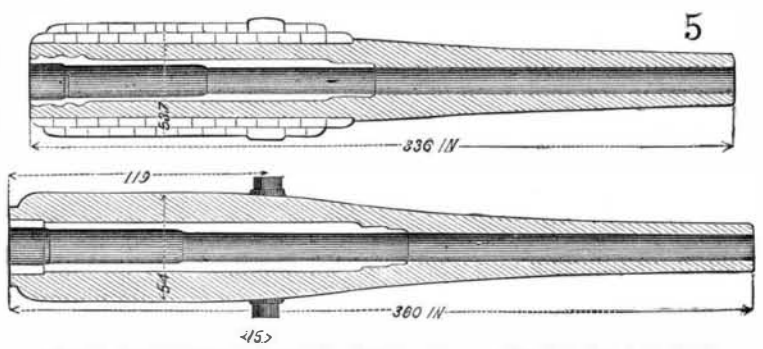

Fig. 5.—SECTIONS SHOWING STEEL TUBE AND HOOPS OF GUN.

The Powlett carriage, on which this gun is mounted, was made at the South Boston Iron Works last autumn, and is worked entirely by compressed air. This system is owned by the Pneumatic Gun Carriage Company, of Washington, D. C. The recoil from this gun, equivalent to starting 800 pounds of iron with a velocity of 1,862 feet per second, is taken up entirely by the compressed air system, and instead of straining and banging the carriage and having the pressure in the cylinders run up from 3,000 to 4,000 pounds per square inch, as is the case with all the hydraulic carriages now in use, the greatest pressure in these air cylinders is 450 pounds per square inch, as shown by a pressure gauge recently attached to the carriage at the Hook. The elevating and depressing of the gun is entirely under the control of one man, and the gun can be sighted to a line in ten seconds. The traversing of the carriage is also controlled by one man, and, instead of taking 12 men 20 minutes to make the traverse, as is the case with the usual type of 12 inch siege carriages, one man can traverse it in 2¼ minutes. This carriage was built for the Ordnance Dept., U. S. Army, and its tests have been so satisfactory that Secretary of the Navy Whitney ordered a board of navy officers, consisting of Captain J. A. Howell, Commander George F. F. Wilde, and Lieutenant Bradbury, to visit the Hook and witness the firing with this carriage. The board were very much pleased with its working, and have made their report. They recommend an 8 inch navy carriage be built, to try this pneumatic system applied to the naval service. They are of the opinion that compressed air for gun carriages, and especially for the stoppage of recoil, possesses decided advantages over all other methods. The South Boston Iron Works have built and erected at Sandy Hook a pneumatic gun loader and tramway for 12 inch carriage, which will convey the powder and shot from the magazine to the gun and load the gun, and, after firing, clean out the bore. This will do away with at least 12 men, and will facilitate the loading and firing twentyfold.

On Thursday, Sept. 2, 1886, the Japanese Commission of military and naval officers which has been visiting the United States and inspecting our ordnance resources went to Sandy Hook to see the 54 ton gun-iron rifle and the Powlett 12 inch siege carriage. The operation of this carriage was shown in all its detail, the gun being run in and out of battery, elevated and depressed, and the carriage traversed backward and forward. The gun loader worked perfectly. With it an 800 lb. projectile was carried 100 feet, elevated, and rammed home into the chamber of the gun in 40 seconds, with the aid of but one man; with the old hand gear system, it takes 8 men 20 minutes to accomplish the loading of a shot. This pneumatic carriage is apparently the type of the future equipment of heavy guns.

For and Against Alcohol.

The total abstinence section of the British Medical Association never fail to testify at the annual meeting. About 160 members of the Association were present at the breakfast at Brighton recently given by the National Temperance League. We need not say that the speakers at this meeting were not of the opinion of a recent writer in the *Revue Scientifique*—M. Fournier de Flaix. M. De Flaix maintains that the outcry against alcohol is utterly unmerited, and that all vital statistics are more favorable in nations in proportion to the use of alcohol. In France, he says, the birth rate is lower and the death rate higher, where the consumption of alcohol is smaller. In England, again, more alcohol is consumed than in France, and yet in France the birth rate, the death rate, and the statistics of crime and suicide are less favorable than in England. Comparing other nations, he reaches the same conclusions, and maintains that alcohol is an alimentary element whose consumption should depend directly on climate. Very different were the teachings of the medical abstainers at Brighton, viz., Dr. Norman Kerr, Dr. Nathan S. Davis, Professor Geikie of Toronto Medical College, Dr. Simon Fitch of Nova Scotia, Dr. Bernard O'Connor, and Dr. Ridge, Secretary to the Medical Temperance Association. Dr. O'Connor said that during his fourteen years of practice he had never prescribed alcohol for any patient. Speaking as a physician to a consumption hospital, he maintained that phthisical patients did much better without alcohol—the night perspirations and the cough were less, and the morning exhaustion was less. But the principal speaker, of course, was Dr. Nathan S. Davis—the president-elect of the approaching International Congress. Dr. Davis' disparagement and denunciation of alcohol were absolute and unconditional. It does not nourish, it does not sustain heat, it does not assist convalescence, it does not improve the pulse in fever, and it is of no virtue in nursing. It is purely evil in its effects. So far from strengthening the heart's action, it depresses it—it paralyzes it. In saying so, he relied not only on his own observations, but on those of Anstie and Parkes. He maintains that alcohol is simply anæsthetic; that it does not remove evils, but makes one insensible to them; and that it arrests and retards all healthy action of the tissues, and tends to the retention and accumulation of effete materials. It is a pity that M. Fournier de Flaix and Dr. Davis did not meet at the Brighton breakfast. There is perhaps a little extremeness on either side, but of the two sides we decidedly lean to that of Dr. Davis. We entirely agree with him and other speakers in thinking that the medical prescription of alcohol should be undertaken only on the strictest grounds. M. De Flaix must remember that France now is not far, if at all, behind England in the consumption of alcohol, and that, besides, she indulges in absinthe, and he will have to explain the fact that in the temperance section of life insurance offices in England the value of life is apparently much greater than in the ordinary section—so much so that in some offices teetotal lives are taken for less premiums or receive larger bonuses. When we read the indictment of Dr. Davis against alcohol, we are tempted to ask if it is the whole truth—if alcohol has no redeeming quality. Admitting that it does infinite harm, does it do no good?—does it prevent no evil? Can the able physicians who recognize its virtues be all mistaken? The question is one for scientific and thoughtful men to discuss gravely, and medicine will not be without much authority and, let us repeat, responsibility in its settlement.

Corn Silk—Stigmata Maydis.

Corn silk has been examined by Messrs. Rademaker and Fischer, who report their results (*Amer. Jour. Pharm.*). Among the more important constituents found were fixed oil 5·25 per cent, light yellow in color, saponifiable, solidifying at 50° Fah., and insoluble in alcohol. Resins and coloring matter (chlorophyl) existed to the extent of 2 per cent, and dissolved along with them by alcohol and ether was 1·25 per cent of maizenic acid, which was first discovered by Dr. Vautier. This acid is freely soluble in water, ether, and alcohol, but insoluble in petroleum spirit. It decomposes the alkaline carbonates, and its salts are crystallizable, the potash salt forming rhomboidal prisms.