THE GREAT FRENCH GUN.

(*Continued from first page*).

does, in a longitudinal direction. In the usual method of hooping it is friction alone that unites the tube and the different superposed series of hoops longitudinally. Now, it is easy to see that such friction is not sufficient to prevent unbreeching. A few slight errors in construction would, in fact, prove of a nature to diminish or even locally suppress the tightness, so that, upon bursting, the tube would slide in the hoops that encircle it.

This grave trouble is done away with in the system of biconical hooping. Col. De Bange has applied his new system to the gun under consideration. The tube of this is strengthened by four series of hoops, which, by reason of their shape, fit into each other, while their joints overlap, after the manner of brickwork. The putting of these in place is very simple. It suffices to heat them to a blue heat, that is to 300 or 400 degrees C., in order to obtain the necessary tightness. The hoops once put on, the constructor had to proceed to the turning. This operation was performed in a machine tool whose cutter moves forward in order to remove the steel shaving, while the tube revolves round its axis. The chamber of the piece was afterward provided with 144 grooves, 0·06 of an inch deep, that had an initial pitch of 30 minutes and a final one of 7 degrees. This rifling was effected by means of another machine tool, which also is very remarkable. In this apparatus the piece is stationary, while the tool moves in order to cut the spirals.

We shall now say a few words about the platform, frame, and carriage, the dimensions and weight of which are in keeping with those of the tube (Fig. 2).

The platform consists of three courses of superposed timbers, of 12 inches section, buried in ballast which rests upon a bed of beton. The great frame weighs 20 tons, and the carriage, inclusive of brake, 22 tons. These two apparatus present a few original and extremely ingenious arrangements. In the first place, we remark an inclined crank, which connects the carriage with the pumps, and moderates the lifting of it. Next, we would call attention to an eccentric roller that operates automatically in the rear, and the importance of which will be at once seen. It is necessary, in fact, that, during its recoil, the carriage shall *slide* over the frame by its back part, and, on the contrary, that when it is put in battery again, it shall *roll* over the said frame. This condition is fulfilled by the eccentric roller placed under the butt end of the carriage, and which a Belleville spring acts upon at the right moment.

Behind the carriage there is an inclined chain, which is connected through other Belleville springs with the hind crosspiece of the frame. When a gun is being put in battery, the velocity of the forward motion is great, despite the play of the pumps, and so it is usual to deaden the shock by means of buffers affixed to the front of the carriage. This arrangement, which has hitherto been everywhere employed, does not prevent the whole from undergoing violent shocks, seeing that the action of the buffers is exerted very low down with respect to the center of gravity. The chain under consideration has the effect of slowing up the forward motion, and of consequently reducing the shock. In the rear of the frame there are buffers also, for use in cases where, through some breakage, the hydraulic brake might not act.

Finally, we would call attention to the bolster, which is very wide, and the axis of which passes through the center of gravity of the entire affair. The reason for this new arrangement is as follows: The majority of the large frames now in use rest upon the platform through the intermedium of a bolster and wheels or rollers. Now, experience has shown that these latter are subject to get out of true, and, indeed, often do so. The arrangement here adopted permits of suppressing these, seeing that the entire system is in equilibrium upon it, and easily adapts itself to every change of direction. As the bolster bolt passes through the center of gravity of the system, the piece's firing field is 360 degrees.

The carriage includes a platform for loading, situated about 8 feet above ground. As for the trunnions, they are 11½ feet above ground. A crane, maneuvered by a sort of pump, serves to lift the projectile to the level of the breech. For aiming, the piece carries at its lower point, below the trunnions, a toothed arc, which is acted upon by means of gearings maneuvered from the exterior.

The axis of the piece may be inclined 30 degrees above and 15 below the horizon. Once loaded, the gun is in perfect equilibrium upon its trunnions.

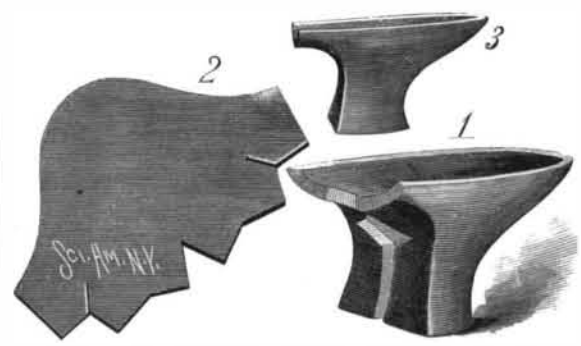
The largest gun that the Krupp works have as yet turned out is of 17 inches caliber, and has an initial velocity of but about 1,500 feet. It is worth $300,000. De Bange's new piece will cost notably less, and its velocity, as we have stated, is 2,130 feet. Owing to the system of hooping, which constitutes its principal original feature, it fulfills all the conditions of security, lightness, and economy that could be required.

This gun is, above all things, a marine one, that is to say, it is capable of being mounted in battery aboard a ship of war, or concur effectively in the defense of the most valuable points of our coast. It may also be used as a siege gun. In a siege, especially, excellent service may be expected from it, seeing that the limit of range of all pieces known up to the present is but 6 miles, while that of the one under consideration is, as we have said, from 10 to 11.—*La Nature.*

MACHINE FOR FORMING HEELS FOR LADIES' SHOES.

To make the high, curved heels, with small bottoms, so commonly used on ladies' shoes, and generally designated in the shoe trade as the "Louis Quinze" style, was one of the most troublesome tasks of the old-time shoemaker, and is so now where the heel is built up by hand from separate "lifts" of sole leather. The latter method is now seldom followed in this country, though it is to a much greater extent in European hand-made shoes; but our manufacturers largely use a wood or other formed heel, covered with some thin leather, and making a light heel, which, especially in goods of moderate cost, will not stand much service and look well. The invention herewith illustrated indicates a new way of making this class of heels, in which good, solid sole leather can be perfectly shaped into the desired form, and made the covering and protector of the wood or other filling used in the body of the heel.

In our engraving, Fig. 2 shows the sole leather blank used for such form of heel, as given in the different views in Figs. 1 and 3, Fig. 1 indicating the shape in which the blank comes from the former. The invention consists in a die with a recess or cavity shaped the same as the heel to be made, and with its front end open, to be closed by a U-shaped crosspiece with dowels passed into apertures in the front end of the die. The top plate of the die is made of the shape it is desired to have the heel seat, and the bottom plate may be set at



SHOE HEEL FORMED FROM LEATHER BLANK.

such angle as required to give an inclination to the bottom of the heel from front to rear. With the sole leather properly wetted, it is not a minute's work to press the blank into shape in the die, adjust the different parts, and pass the die into a press, where it is allowed to remain a few minutes, the operator being supposed to have several sets of dies, so that when the last has been thus put into the press the first will be ready to come out, and the work will thus be continuous. This die, can, of course, be used with lighter leathers, and, there being no opening in it except at the front, the entire surface is certain to have a smooth, unbroken finish; but it leaves nothing to be desired in the forming of a good, solid, sole leather covered heel, which cannot get out of shape, which may be brilliantly burnished, and which cannot fail to have excellent wearing qualities.

This invention has been patented by Mr. Friederich Ortlepp; all further information can be obtained from Mr. Joseph S. Kaliske, 79 Reade Street, New York city.

A Good Idea.

According to our English contemporaries, the practice of litigants conducting their cases in person is one that seems to be daily gaining ground in England. Occasionally a jury will make strange blunders, says a writer, but, as a rule, what they want is to have the facts brought fairly before them. This a counsel often does not do. He is thinking of the rules of evidence, or he fancies that it would be politic to suppress this particular fact or to avoid that particular circumstance, or in some other way to finesse the evidence. This is what a jury dislike. They can get on much better with a litigant in person who blurts everything out with a supreme contempt for all established rules, and who, if a thing is not evidence, will somehow make it so.

A Steam Canal Boat.

A canal steamer on a new principle is to be built at Albion, N. Y. This novel boat will be 98 feet long and 17 feet 8 inches in width; her boiler will be 10 feet long, 5 foot shell, with the fire box in the center of the boiler. The boiler will be horizontal instead of upright, and run athwartship instead of fore and aft, with an engine of full capacity. There will also be built three consorts for this steamer, with a capacity of 25,000 bushels of wheat, while the steamer's capacity will be 6,000 bushels, making an entire capacity of 31,000 bushels. The steamer, when on the river, will have one consort ahead of her and one on each side, and on the canal one ahead and two behind.

New England Spruce.

The lumber used in the construction of a building in the Eastern States, is totally different from that used in any other locality. To the Pennsylvania man there is no wood for framing purposes equal to hemlock; the Michigan man is equally as firm in his opinion of white pine; but let either of these men advance his theories to the New England builder, and he would find he had met an equally strong adherent to the use of spruce. For framing purposes spruce is used almost exclusively. For boarding in, it is the custom to use hemlock or matched white pine, according to the quality of the work desired. Hemlock is generally used for under and spruce for upper floors, and in many instances a preference is shown for spruce ceiling over white pine.

The most extensive spruce forests are in Maine, and most of the lumber cut in that State is shipped by water to the various distributing points. The mills in New Hampshire and Vermont supply the interior points and deliver necessarily by rail. The mills which make a specialty of flooring are generally equipped with the best of machinery for dressing, and not a few have first class dry kilns. Undoubtedly the manufacturers of dressed spruce realize that to sustain the demand much depends upon the quality of the mill work, and the result has been that in the past few years especial attention has been paid to that branch of the business. Dealers whose yards are located at points along the eastern coast generally purchase of the manufacturers, who ship from the Kennebec or Penobscot rivers. It is customary to make up cargoes of random sizes and rough boards, which of course are sorted for sizes at their destination. Schedules of special sizes are also shipped in this way. Floor boards, if dressed, are generally shipped in box cars. In the matter of dressing, some prefer flooring dressed one side and jointed; others will use it dressed one side and matched. The latter method, in case the boards are not thoroughly dry, is undoubtedly the better.

Some idea of the spruce business of the Boston market can be obtained from the returns to the Inspector General's office for the first three months of the present year. During that time there was inspected 848,294 ft. of spruce boards and 1,171,167 ft. of plank and timber. In addition to this amount, there were many car loads of boards which arrived from mills in Vermont and New Hampshire which were sold from the car and no returns made. The present quotation on random cargoes—by that is meant ordinary sizes of framing timber—is from $12.50 to $13.50; special schedules by rail, $13.50 to $14.50. First clear spruce floor boards sell in eastern Massachusetts at $18 to $18.50, and second clear at $2 a thousand less.—*N. W. Lumberman.*

Piping Blackbirds.

When reared by hand from the nest, the blackbird is capable of forming strong attachments, and from his wonderful imitative powers will make himself a great favorite. He will, if trained when young, learn to whistle almost any tune that may be taught him. The best, and perhaps the quickest, way is to take him, when about six weeks or not later than two months old, to a quiet room away from any other bird, and in the evening and the first thing in the morning give him his lesson. The tune may be played on a flute or other wind instrument. It is advisable to feed him *before* commencing operations; and some bribe or other, as, for instance, a lively worm, should be placed in his sight. Play over a portion of the tune you wish him to learn, and he will evidently pay particular attention to it. Repeat it, with precisely the same time and expression, say twenty times; then give the bird a little quiet, so that he may, if he will, have an opportunity of imitating it. If he should make any attempt, instantly give him his reward, coaxing and caressing him meanwhile. Being, for a bird, possessed of strong reasoning powers, he will soon discover why the worm or other bribe is given him, and before long will understand how to earn it. When once learnt, the tune or tunes will never be forgotten, but pass, as it were, into its song. It is rather a tedious undertaking, but the result is invariably satisfactory. A blackbird will also imitate other birds very minutely, and though there is little variety in his natural song, it is made up for by its pure, flute-like tone and full volume. It most readily imitates the thrush, but it will catch many notes from the nightingale, to which bird its tone has most resemblance, were it not for the introduction of several harsh notes. When kept in confinement, it is always advisable to bring it up when young near to some good singing bird, as it will thereby learn its neighbor's song, and, intermixing the notes with its own, make a most agreeable songster.—*Canaries and Cagebirds.*

IT may be of interest to those who preserve and bind the SCIENTIFIC AMERICAN to know what the law considers this paper to be worth per page. We take the following from the N. Y. *Sun:* "John Fallon, a well dressed, intelligent looking young man, who refused to say where he lived, was held in $100 bail yesterday for tearing a leaf from a copy of the SCIENTIFIC AMERICAN in the Astor Library.

New War Ships.

The Govanni Bausan, which has been built by Armstrong & Co. for the Italian Government, has completed the necessary trials, and is about to leave England for the Mediterranean. This vessel has been built generally after the design of the Esmeralda, but is somewhat larger, her length being 280 feet; breadth, 42 feet; and draught 18½ feet. Her displacement is about 3,100 tons. The armored deck in this vessel is 1½ inches thick. The armament consists of two 10-inch 25-ton breech-loading guns as bow and stern chasers, six 6-inch 4-ton guns on the broadsides, two 6-pounder rapid-firing guns, and several Nordenfelt and Hotchkiss machine guns. What is described as a revolving turret is placed at each masthead; in each of these a machine gun will be placed. On the gun carriages steel shields are fixed for the protection of men against lighter missiles. There is a torpedo ejecting tube beneath the ram for the under-water discharge, and two above-water discharges forward. There is a powerful hydraulic crane for lifting boats, and the steering gear is on the Elswick hydraulic principle. On the official trial, which was made about a fortnight ago, the vessel was run at full speed for six hours, forced draught being used all the time. The indicated horse power was about 6,000, the revolutions averaged 116·5 per minute, and the speed was 17½ knots per hour, or about 20 miles.

After years of trial and experiment, her Majesty's torpedo ram Polyphemus is pronounced complete. This interesting vessel lately left Portsmouth Dockyard for a full power trial in the Solent. By means of forced draught, the fan engines running over a thousand revolutions a minute, the boiler pressure was brought up to the standard of 110 pounds. The mean power of the engines was 5,520 horse power indicated; the maximum reached on the run was 5,780 indicated horse power. Four runs were made upon the mile, which showed that the vessel was steaming at the rate of 17·847 knots. This was on a draught of 20 feet forward and 21 feet 3 inches aft. Trials have also been made with the broadside torpedo discharging gear which gave so much trouble at first, and the result has been that the Whiteheads can be ejected at full speed without jamming.

The Aquidabau, the new Brazilian armor-clad, has recently been completed by Messrs. Samuda Brothers, and lately ran a very successful series of trials off the Maplin. This vessel is of the same general description as the Riachuelo. The new vessel is 280 feet long and 52 feet wide, the displacement being 5,000 tons. The mean draught on trial was 18 feet, the vessel having been designed not to draw much water, as she is required for service in the South American rivers. The hull is built of Siemens steel and sheathed with wood. The ram is a solid gun metal casting, and the stern frame is of the same material. The machinery is protected by a water line belt of steel-faced armor, 11 inches maximum thickness and 7 feet wide. There is an armored deck 2 inches thick, carried fore and aft, and arranged to protect the steering gear aft, and also to strengthen the ram. The armament consists of four 9-inch 20-ton breechloading guns, placed in turrets protected by 10 inch armor. On the upper deck there are two 5¾-inch breechloading guns at the bow and two similar weapons at the stern. There are fifteen Nordenfelt guns, and five ports for the discharge of torpedoes. The engines are by Messrs. Humphrys, Tennant & Co., and are of the three-cylinder compound type. The Aquidabau was tried in sea-going trim on the 16th ult. With natural draught the indicated horse power was 5,270, and the speed 15·257 knots. With closed stokeholds and fan draught the power was raised to 6,201 indicated horse power, and the speed 15·818 knots. In the forced draught trial only six of the total number of eight boilers were used. Two runs on the mile were made with only one screw working, the speed being at the rate of 11·447 knots, 15 degrees of helm being required to keep the ship straight. A half circle was turned against the screw in 3½ minutes. A six hours' coal trial was made on the 19th ult. The official report states that the consumption was at the rate of 45 tons a day when the ship was steaming at her contract speed of 14 knots. As the coal bunkers carry 800 tons, the Aquidabau could steam over seventeen days on her bunker coal, and cover a distance of above 5,700 knots.

American Locomotives in New Zealand.

On the subject of American *vs.* English machinery, Sir Julius Vogel, ex-Agent-General for New Zealand, made a very interesting statement at Auckland on February 17. Sir Julius, who is now the Colonial Treasurer, spoke for several hours on the past, present, and future of New Zealand, and in the course of his speech used the following language:

"We sent home an order for certain locomotives after a type which we had running in the colony, and which were obtained from America. It was thought by the late government that it was unpatriotic to go to America for goods, so the plans and specifications were sent home to England, and the weights and sizes given most exactly. When these locomotives were about finished, the engineers telegraphed out that they were about to ship them, but that we had better order plant to strengthen our bridges and culverts, as it would not be safe to send the locomotives over them. Their idea was that we should make our railways to suit their engines. We telegraphed that we should do nothing of the kind, that we had limited the weight of the engines. They replied they could not be made according to the specifications we had supplied. But the answer to that was that we had them running in the colony, and we refused to take them. Well, this is what happened: We sent an order by telegraph to America for these engines, and such is the confidence we feel in the character of the material which will be supplied that we are prepared to take them without inspection there, while we cannot take the suspected ones from Great Britain."

Sir Julius also made use of the following language: "I cannot help saying that under the free trade system of Great Britain there has been a great deal of scamped work and adulteration going on, and that buying in the cheapest market and supplying as cheaply as possible, manufacturers have been in the habit of not conscientiously supplying the best articles. It is only quite recently that by a happy accident—an iron axle falling to the ground and breaking while being unshipped—we were saved from sending forth death and destruction on our railways by using rotten axles sent out from Great Britain."

Australian Timber.

For constructive purposes in dockyards, piers, bridges, house carpentry, coachmakers' and wheelwrights' work, railway building, fencing, and piles, nearly the whole of the *Myrtacea*, of which New South Wales possesses something like fifty varieties, are extremely valuable, and certain of them incomparably so. For the uses of the cabinetmaker and the house decorator, the timber familiarly known as the black apple, the Moreton Bay pine, the red cedar, coach wood, Clarence light yellow wood, turnip wood, rose wood, Illawarra mountain ash, tulip wood, myall, cypress pine, and others, is capable of being worked up into furniture and paneling, beautiful in grain, rich in color, and susceptible of a high polish. The timber of the prickly leaved ti-tree (*Melaleuca styphelioides*) is said to be incapable of decay; that of the white ti-tree (*Melaleuca leucadendron*) is said to be imperishable under ground; that of the turpentine tree (*Syncarpia laurifolia*) resists the attacks of the *Teredo navalis* in salt water; and that of the brush bastard or white box (*Tristania conferta*) has been known to preserve its soundness, when employed in building the ribs of a ship, for a period of thirty years. To the carver and wood engraver the cork wood (*Duboisia myoporoides*), the rose wood (*Dysoxylon Frasernum*), and the pittosporum (*undulatum*) commend themselves as serviceable substitute, for European box; while the cooper finds in the native ash (*Flindersia Australis*), the silky oak (*Grevillea robusta*), the stave wood (*Tarrietea actinodendron*), the green and silver wattle (*Acacia decurrens* and *Acacia dealbata*), and the swamp oak (*Casuarina quadrivalvis*), excellent material for staves. Other kinds of timber are specially adapted for oars, spokes, and naves, tool handles, telegraph poles, and turners' work.

The Electric Lighting of Trains in Germany.

The railway administration at Frankfort-on-the-Main have recently repeated some experiments on the lighting of trains by electricity, which, according to our foreign exchanges, have been attended by most satisfactory results. The experimental train was composed of a first, second, and third class carriage, and a luggage van, which contained a special compartment for the dynamo and accumulators. The dynamo was of the Moehring type, and was driven by a suitable arrangement of pulleys and belts from the axle of the wheels of the van, and at a velocity of 700 revolutions per minute, when the train was running at a speed of 18 to 42 miles an hour. When the train is running at full speed, the lamps remain in circuit while the accumulators are being charged; but when the speed is less than 18 miles per hour, then the lamps are thrown out of circuit, and the current is supplied direct from the accumulators, a specially constructed automatic commutator regulating its intensity. During the day the lamps are thrown out of circuit, and the 26 accumulators are charged by the dynamo when the train is in motion.

The train was lighted by 12 incandescent lamps, of which two were in the luggage van, two in the third class carriage, four in the first, and the remaining four in the second class carriage.

These experiments clearly demonstrate, says a contemporary, the practicability of lighting trains by electricity, the light being perfectly steady during the journey, and at variable speed, and even during stoppages at stations: only at starting a slight oscillation was perceptible. As all is regulated automatically, no attendant is required, except at starting. The experiments were continued for six weeks, at the end of which time everything was found in perfect order. The cost of lighting is estimated at ten centimes per lamp per hour.

Photo-Mechanical Processes of Illustration.

THE ARTOTYPE.

The artotype is made in the following manner: A plate, preferably of glass, is carefully coated with a solution of gelatine containing bichromate of potash. It is then dried, and an ordinary photographic negative is placed in contact with it and exposed to the action of light, which hardens all the parts corresponding with the transparent parts of the negative or the dark parts of the picture. After the proper exposure, the plate is washed in cold water to remove all the sensitizing material, and it is then dried. The gelatine surface will be found to have changed, so that it will act precisely like a lithographic stone; when moistened, the parts that were protected from light by the opaque parts of the negative absorb water, while other parts remain dry. A roller charged with fatty ink is rolled over the plate, the ink adhering to the dry parts and being rejected by the parts that have absorbed water. Paper is now placed on the inked surface and subjected to pressure, when the design will be transferred to the piece of paper. Then the moistening, inking, and pressure are repeated until the required number of copies has been produced.

THE PHOTOGRAVURE PROCESS

takes a plate, and covers it with a solution of bichromated gelatine containing a fine powder to give it a grain. This is exposed to light through a negative, just as is done in making artotypes. Then it is washed in hot water, which dissolves all the gelatine that was not affected by the light, carrying with it the fine powder, and which leaves the gelatine with the grain in all the dark parts of the picture. The plate is now dried and placed in an electro-plating bath, or an impression in wax is made from the gelatine plate and then placed in an electro-plating bath. Copper is deposited until sufficiently thick, when the plate is removed and put into the hands of an engraver, who repairs all the imperfections and makes any other desired changes with the burin. Impressions are taken from the plate in the same manner as any copper or steel plate engraving is done. The cost of printing photogravures is very nearly the same as that of printing artotypes, but the photogravure plate costs much more than the artotype plate, and unless the edition required is very large, the plate alone will cost more than the complete edition in artotype.

BRAUN'S REPRODUCTIONS.

Paper is covered with gelatine containing India ink, lampblack, or any other desired pigment, until the whole surface is thickly coated, when it is dried. In making a picture, this prepared paper is immersed in a solution of bichromate of potash for a few minutes and then dried in the dark, after which it is exposed to light in contact with a negative. When sufficient insolation has taken place, the paper is moistened and pressed face downward upon a prepared glass plate. After a pressure of several minutes the glass and paper are put in hot water, dissolving the gelatine, and loosening the paper, that the latter may be stripped off, leaving the gelatine on the glass. The gelatine continues to dissolve, until only so much of it is left as has been sufficiently hardened by light to resist the solution by the hot water, when washed away, until only enough is left to form the picture; the picture after drying is transferred to paper, then finally mounted on cardboard.

THE WOODBURYTYPE

is made by insolating a sensitive gelatine film attached to glass, washing the unchanged gelatine away, and leaving only the parts that form the picture. This, after being dried, is pressed mechanically into a plate of soft metal, making an intaglio, into which is cast a mixture of hot gelatine and any coloring matter. Paper is pressed with a flat pressure and allowed to cool, when the pigmented gelatine will be firmly attached to the paper, which is dried, trimmed, and mounted. The Woodburytype is adapted only for pictures of comparatively small dimensions. Braun's pictures and the Woodburytypes have to be mounted; this is found to be of great disadvantage in using them for book illustrations. Both are merely thin films of gelatine, and they cannot compare in permanency with artotypes, photogravures, and heliogravures.

The Effect of Tree Planting in Kansas.

In his Arbor Day proclamation, the Governor of Kansas said that the State, which the pioneers found treeless and a desert, now bears upon its fertile bosom "more than 20,000,000 fruit trees and more than 200,000 acres of forest trees, all planted by our own people." The Governor also says: "That there has been an increase in the rainfall in Kansas is fully proved by the statistics of our oldest meteorologists."

A Hint for Amateur Photographers.

This is the season for showers, rainbows, and thunder storms. We suggest that a photograph of a first-class rainbow might be an interesting subject for experiment with the camera. Also a night exposure of a plate when the lightning is vivid. Photos of lightning strokes have been made; but we call to mind none of the rainbow.