THE NAVY RAPID FIRE GUN.

The rapid fire cannon designed by Ensign R. B. Dashiell, United States navy, having been adopted for the armament of the ships of the new navy, the following description and accompanying views of the gun and mechanism will be of interest to our readers. This design of breech closure is intended for guns of 4, 5 and 6 inch calibers, firing projectiles of 33, 50 and 100 pounds respectively. All these guns use a solid-drawn metallic cartridge case with the projectile gripped in the mouth of the case, like a rifle bullet in a small arm cartridge. Smokeless powder is used, giving velocities of over 2,500 feet per second. The gun and its ammunition are American throughout. The cartridges are made by the Winchester Arms Co., of New Haven, and the smokeless powder by the United States Naval Torpedo Station at Newport.

The fermeture of the gun is on the slotted screw system. The plug is supported when withdrawn on a hinged tray and collar of suitable shape. All operating mechanism is carried on the tray casting, except the trigger, which is on the gun.

A curved translating arm of bell-crank lever form is pivoted on the tray at one end. A vertical toe at the other end engages an undercut score in the breech plug. When this lever swings on its pivot, the plug, if unlocked, will be withdrawn from or entered into the breech.

In the elbow of this arm is pivoted a horizontal cogged segment, formed in one piece with a long lever ending in a vertical handle or grip. A curved slot in the tray allows its pivot pin to move with the pivot of the translating arm as a center during longitudinal motion of the plug on the tray. This cogged segment engages a series of horizontal cogs on a rack bar which slides in a groove in front of the tray. The left hand end of this bar is provided with vertical cogs engaging another series on the lower part of the breech plug. A stop pin on the face of the breech limits the travel of the rack. The length of the rack is such that its extreme right hand cog is immediately below the pivot pin of the translating arm when the plug is unlocked.

The usual double-acting latch is fitted to the tray.

The plug being locked, a pull on the hand lever rotates the cogged segment, thus unlocking the breech plug by means of the rack bar described. As soon as the plug is unlocked the stop pin will have checked the motion of this rack and the center of motion will be transferred to its right hand cog, which is now immediately below the pivot pin of the translating arm. The arm and lever consequently swing together, and the plug is withdrawn on the tray and swung to one side clear for loading. As the plug comes out a groove, cut in its threaded lower segment, passes over the central tooth of the rack.

In returning the plug to the breech two forces will be at work in the mechanism—one to rotate the plug, the other to push it home. The first is checked by the groove in the plug engaging the tooth of the rack mentioned and pulling the plug against the tray rib. Only the motion of translation can thus take place. As soon as it is entirely off the tray ribs the plug can revolve, but being then home in the breech its translating motion ceases and revolution locks it in place.

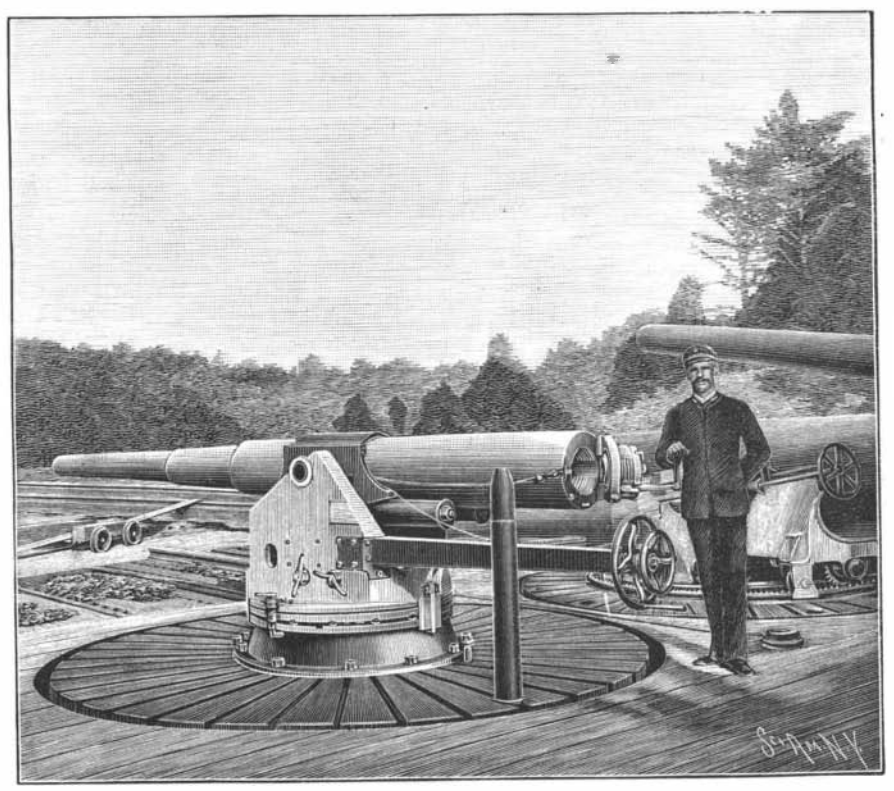
The extractor is a strong bar kept down by a mild spring. It passes through a hole in the plug so as not to interfere with the threaded parts. By utilizing a certain amount of fore and aft "lost" motion the extractor is kept from slipping off the cartridge head at the same time that the plug, when pulled quickly to the rear through this "lost" distance, acts very powerfully as a hammer to extract the empty case. The extractor is shown in its forward or pulling position. When pushing a cartridge home the extractor hook cannot rise and catch until it has been pushed back, by the forward motion of the plug, to its rear position. It can then snap over the rim of the case and is ready for the blow from the breech plug in extraction.

The firing mechanism consists of a straight firing pin with cone-shaped shoulder. A spiral spring actuates it, being held to its work by a loose, spool-shaped sleeve. A cocking lever is pivoted to the plug, its upper end running along a cam groove in the tray collar, while its lower end is forked to engage over the spool-shaped sleeve of the firing pin. When unlocking, this lever moves the sleeve to the rear, cocking the pin on the toe of a horizontal sear bar. When locking, the sleeve is given motion in the opposite direction, which compresses the spring, leaving the firing pin cocked. When fully locked, the outer hook of the sear engages the trigger. A cap over the rear end of firing pin prevents all danger from defective primers.

It will be seen that the gun cannot be fired unless the mainspring is compressed and the sear and trigger engaged, neither of which takes place until the last instant of locking.

The lanyard leads forward, around a pulley near the trunnions, if desired, so that the gun captain and lanyard will be out of the way of the gun servants about the breech, and the pull for firing will be independent of the elevation of the piece.

The advantages claimed for this mechanism are efficiency, with cheapness of manufacture. The quick-acting part is applicable to any gun with slotted screw fermeture in which the breech plug is worked by manual power.



THE DASHIELL RAPID FIRE GUN.

The following selections from the "Annual Report of the Chief of the Bureau of Ordnance" show the behavior of the gun in service:

"The recently adopted breech mechanism for rapid-fire guns of 4, 5, and 6 inch calibers have been put to a most thorough test, with both good and defective ammunition. Four-inch gun No. 11 was fired 248 times. The mechanism was worked about 8,000 times with tight-fitting cartridge cases. These cases had to be hammered into the gun, and were selected for the purpose of testing the extractor.

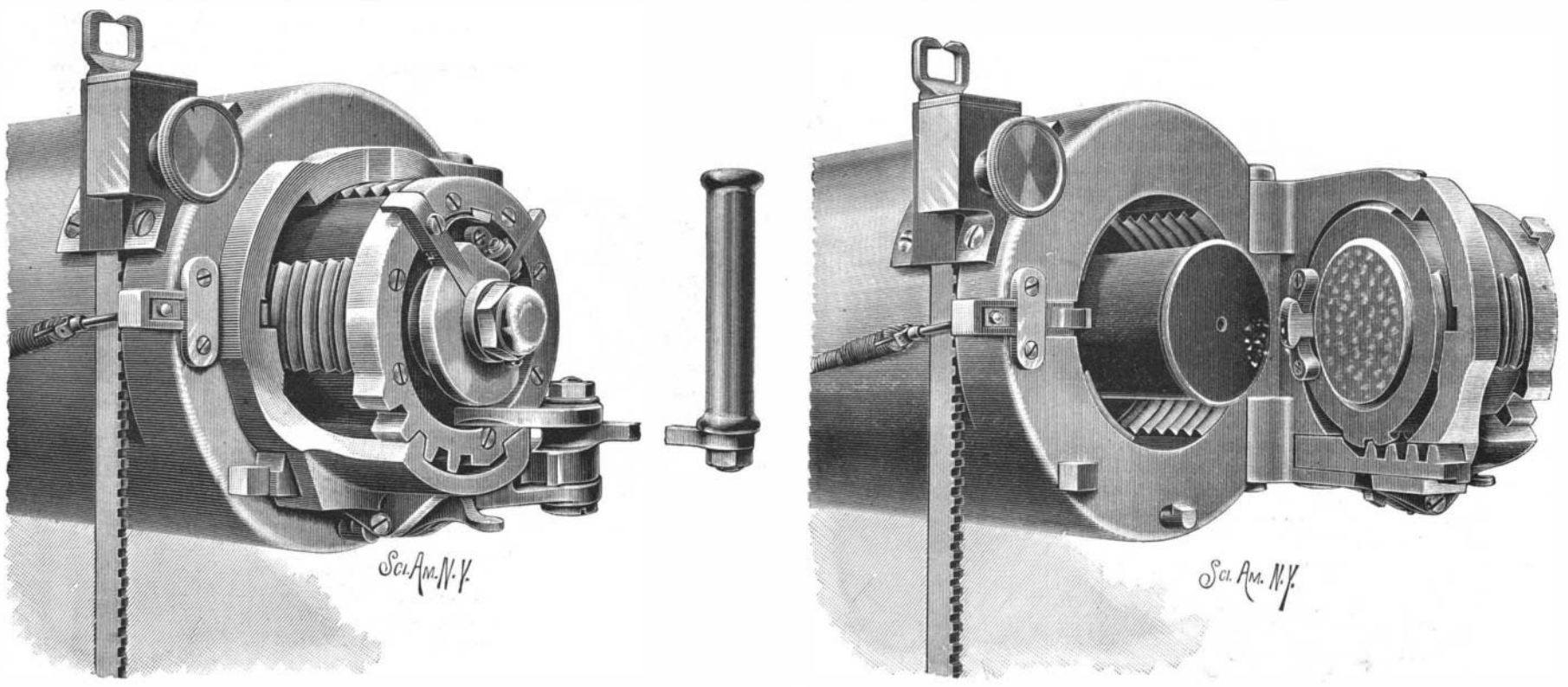
"There has been no failure in the action of any part. A test for rapidity of fire was made before the chief of bureau and bureau officers. Five rounds were fired in seventeen seconds, using experimental cases. Since then, on two occasions, five rounds have been fired in fourteen seconds. On the second trial, the gun was laid at 10° elevation, and all five projectiles were in the air together.

"Similar exhaustive trials have been held with the 5 inch rapid-fire mechanism. Five rounds have been fired, in two instances, in 19 seconds. The charge and projectile made up in one weigh 95 pounds (with brown powder) and can be easily handled by one man.

"There have been no cartridge cases as yet for the 6 inch quick-firing gun, the DeBange check being used for obturation. The 6 inch rapid-fire mechanism was tested in competition with the service mechanism by a board of which Captain J. A. Howell, United States navy, was the senior member.

"The conditions of firing were precisely similar with each gun, the elevation 3°, service carriages, gun sponged after each round.

"The gun, with the ordinary service mechanism (Mark III), was fired 10 rounds in five minutes and two seconds, while that fitted with the quick-acting mechanism was fired by the same crew ten rounds in two minutes and fifty-six seconds."



THE DASHIELL RAPID FIRE GUN.

These guns will form the main batteries of the small cruisers and the secondary battery of the larger vessels of the navy.

FRENCH ingenuity has contrived an improved stone-cutting saw of remarkable efficiency—a circular saw having its edge set with black diamonds in the same way as the straight blades; but as the strain on the diamond is all in one direction, the setting can be made much firmer.

The German Enameled Sheet Iron Trust.

Mr. Albert H. Washburn, our commercial agent at Magdeburg, Germany, in his April official report states that the depressed state of an overstocked market during the past two or three years has recently led to the formation of a trust by German manufacturers of enameled sheet iron. The avowed object of the combine is to prevent over-production by regulating the output upon the home market. Incidentally a scale of prices, rebates, and other charges are agreed upon. No attempt is to be made for the present to control the sale of exported wares, even when sold to German buyers.

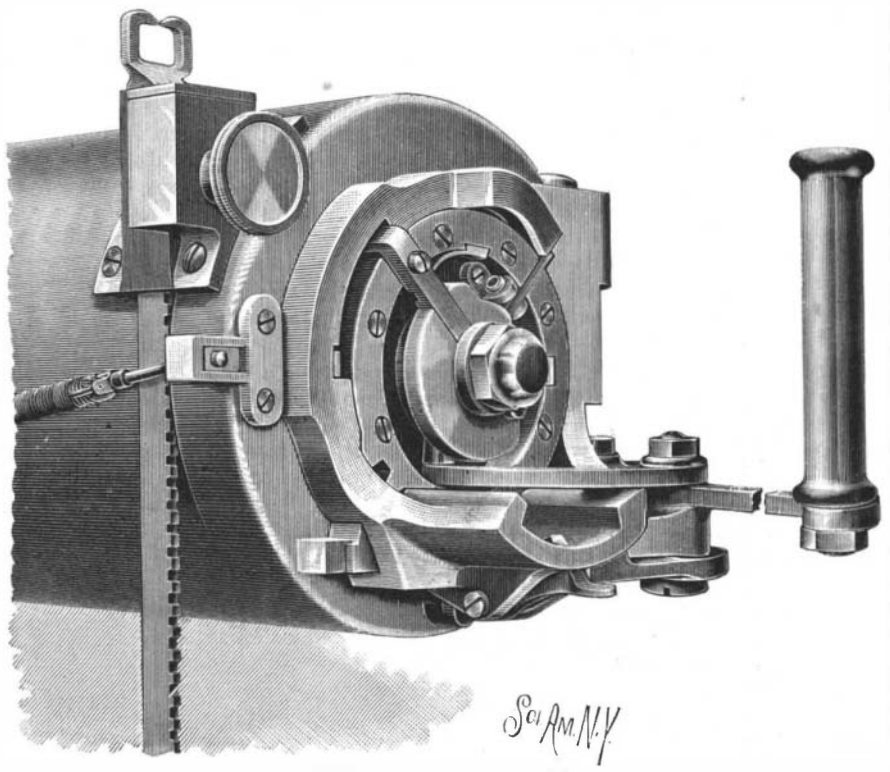
The principle upon which the new association will operate is to measure future production by the general average of past sales, with due regard to any extraordinary conditions that may arise. Thus it is supposed that the total production for 1893 will represent the average of domestic sales for the years 1890, 1891, and 1892, reckoning from January 1 to December 31. A provisional plan was adopted to this end. A committee named for the purpose collected the figures for the years mentioned and computed the average for the present year. The exact quantity to be produced by each factory was then apportioned in general meeting.

It is not proposed to effect sales through the central agency. Every firm secures its own orders, as heretofore, and is responsible for the carrying out of its contracts. Prices and rebates are for the most part constant. The only exception is where a firm is not producing the prescribed quantity through lack of orders. If this continues for a period exceeding a month, the president of the trust is authorized to permit a scale of lower prices until the limit of production has been reached. One firm is permitted to take over the orders of another, but no firms thus uniting may exceed their combined quota. If, at the end of the year, certain works have failed to produce their allotted quantity, they are to be reimbursed for the difference at the rate of 10 marks per 100 kilogrammes by those firms over-producing. This is adjusted through the central bureau. Works partially or wholly ceasing operations are not entitled to remuneration for the time so lost.

Certain checks are imposed. Pending a permanent arrangement, a committee was appointed to establish the correctness of the figures reported. Whenever a decrease in sales is ascertained, a corresponding decrease in quota is promptly ordered. Each firm is required to forward semi-monthly to the central office a statement of actual shipments. Statistical summaries based upon these reports are to be published every two weeks for the information of members of the association. After a more complete organization has been effected, the directors of the various groups making up the trust are to hold quarterly sessions to fix, with the aid of the published statistics, the production for the succeeding quarter. In this manner every firm will be enabled to estimate with some exactness the quantity it is entitled to put upon the market.

The trust is made up of the manufacturers in Rhenish Westphalia, Saxony, and southern, northern, eastern, and central Germany. Thus far about thirty works are included. Affairs are directed through a president in charge of the central office, the general meeting of members, and the directors of groups. The president and vice-president are elected for one year, and the former presides at all general and group deliberations. One vote represents an annual shipment of 100 tons or a fraction thereof, but no establishment is entitled to more than five votes. Guaranty deposits at the rate of 20 marks per ton are required to be made with the central office by each firm. In case of failure to comply within four weeks with an order to pay made in accordance with the terms of the agreement, the amount involved is drawn from the fund of the defaulting firm. The security must be replaced within two weeks. The trust compact expires December 31, 1895, until which time no detail can be changed without unanimous consent. Members bind themselves not to erect new works or interest themselves in firms outside of the trust.

The association is to devise means to prevent goods intended for export finding their way to the home market. Each group is to establish a central depot for the sale of damaged wares. The principal office is located at Berlin, and the president—Dr. H. Claus, of Thale—is a successful inventor of various new enameling processes.



THE DASHIELL RAPID FIRE GUN.

Do Ants Talk?

This query is made by a writer in the *Magazine of Natural History*, and he then goes on to say: I one day saw a drove of the small black ants moving, perhaps to better quarters. The distance was some 150 yards. Almost all which came from the old home carried some of the household goods. Some had eggs, some had what may have answered for their bacon or meat, some had one thing and some another. I sat and watched them closely for over an hour. I noticed that every time two met in the way they would hold their heads close together as if greeting one another, and no matter how often the meeting took place this same thing occurred, as though a short chat was necessary.

To prove more about it, I killed one who was on his way. Others being eye witnesses to the murder went with speed, and with every ant they met this talking took place as before. But instead of a pleasant greeting, it was sad news they had to communicate. I know it was sad news, for every ant that these parties met hastily turned back and fled on another course, as much as to say, "For the king's sake and for your safety do not go there, for I have seen a monster, just behind, that is able to destroy us all at one blow. I saw him kill one of our family. I do not know how many more are killed." So the news spread, and it was true. How was the news communicated, if not by speech?

Dangers from Gas Pipes and Trolley Systems.

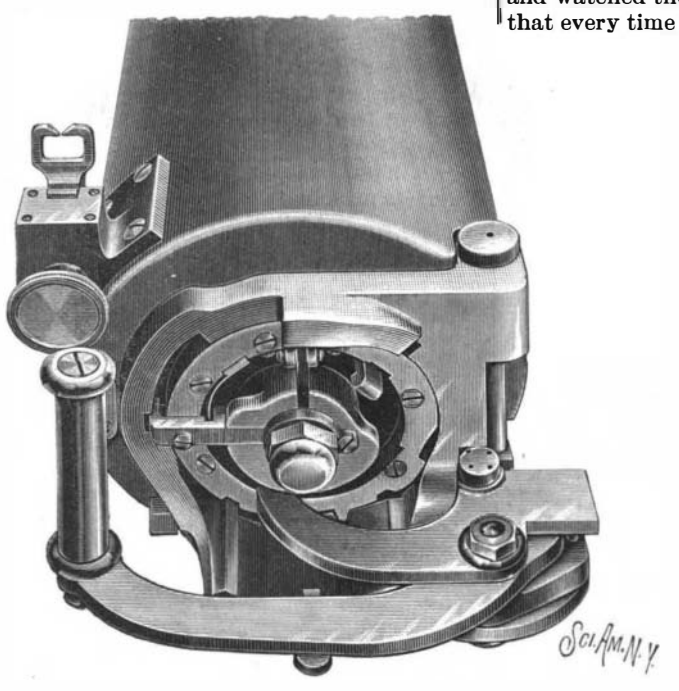
Mr. John R. Pearson, writing to the *American Gas Light Journal*, describes a peculiar accident to one of the natural gas mains, caused by the trolley system used by the Citizens' Street Railroad Company, of Indianapolis.

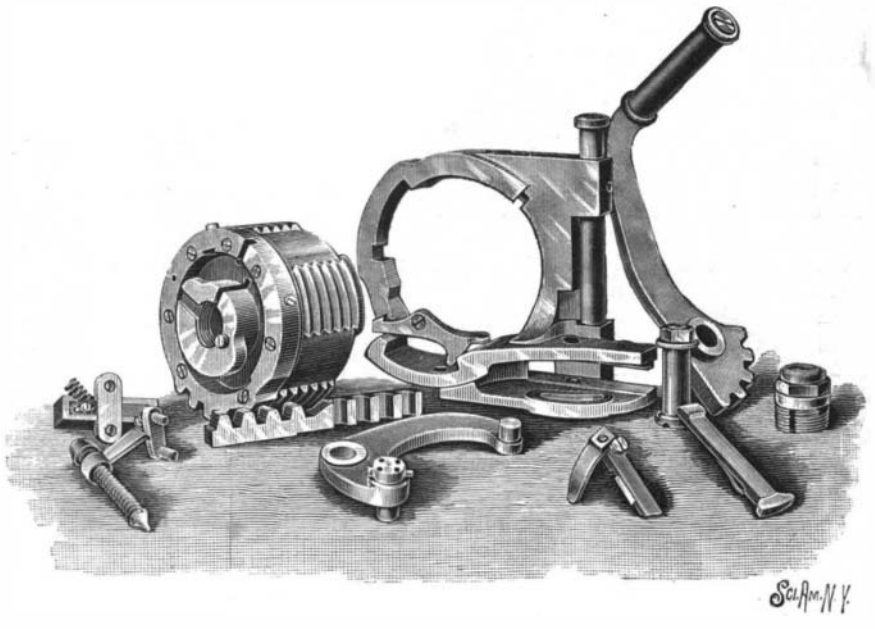
On Illinois Street the concrete and asphalt render the street impervious to moisture. Hence the earth and sand, for the distance of several feet below the street, form a very poor conductor. When the leak of electricity from the iron pole of the street car made its way to the ground, there was no way through the ground for it to return by the ground circuit to the power house. Owing to the dryness of the earth, as above described, the base of the iron street car pole being in contact with our old, abandoned cast iron gas pipe, and the fact that the iron gas pipe was corroded, as was also the street car pole, rendered the contact between the two so poor that necessarily the current, in passing from one to the other, created an arc, the same as an arc in one of the street lights.

The electric arc heat is the most intense heat that it is possible to obtain. Hence the current, in making this arc, melted the cast iron pipe, also the bottom of the street car pole, in its path to find a ground, which it did, following the cast iron pipe for about 300 feet north. At this point it encountered a wrought iron natural gas pipe, that crossed the cast iron pipe, which furnished the ground sought for by the current. The natural gas pipe was, to some extent, also corroded. Hence the current, in its seeking a ground through the natural gas main, created an arc, melting both the pipes, about the same as had occurred at the base of the street car pole. The natural gas then followed along the old artificial main, until it reached the street car pole that was melted by the arc, passed up through the center of the hollow pole and escaped into the air.

The first car that passed over and the trolley created a spark that set fire to the natural gas, the flame from which leaped into the air 15 feet, melting the main current wires in a few minutes, and stopping all cars on the line for several hours.

As all large cities are adopting the electric car system, I fear that grave results will occur to water and gas mains, unless some better means are adopted than are now used to return the current back to the generator station. In our case, it would have been a very serious matter to us if the natural gas had found its way into the cellars or basements of the large blocks adjacent instead of coming out at the top of the pole; for then there would certainly have been an explosion, with great damage to life and property.





THE DASHIELL RAPID FIRE GUN.

RAVAGES OF TIGERS.—A man-eater in India was known to have killed 108 people in three years, and another killed an average of 80 persons a year for the same period. A third caused thirteen villages to be abandoned, and 250 square miles of land to be thrown out of cultivation.

Photographs in Colors.

With the April issue of the *Photographische Correspondenz* there is given a specially interesting example of polychrome printing by the three-color method, the three negatives having been obtained from a group of natural flowers by Herr Hruza, and the printing executed in collotype by Herr Sieger.

The example consists of a set of the three impressions, and of the combination; this latter being far better than any polychrome print which we have yet seen as made on the three-color system, and it includes such delicate gradations of tint as one would expect to require ten or twelve stones if produced by ordinary chromo-lithographic means.

The three elements are spoken of in the paper as red, yellow, and blue; but these component tints are not precisely in accordance with the system as used by Cros and Ducos du Hauron; nor, on the other hand, with the later method adopted by Ives. In both of these systems red is used as one of the colors; but while in the older plan blue and yellow were employed to complete the trio, Ives used a bluish-green and a sort of lilac as the remaining color elements. In the example before us, while yellow is still retained, the bluish color is represented by a tint intermediate between the direct blue of Ducos du Hauron and the bluish-green of Ives. On the other side of the scale, too, a sort of purplish red is used, again intermediate between the positive red and the lilac referred to as used by Ives.

The "red" print of Herr Hruza is from a negative taken through a green light filter, while the negative for yellow was taken through a violet filtering medium, and the negative for the "blue" print was taken with an orange-colored light filter.

The set of three-color prints is especially interesting, when studied in connection with the combination. Herr Hruza suggests that the original proposal of Cros and Ducos du Hauron may be considered to have been a practical failure, mainly from the difficulty of obtaining at that time (1868) plates sufficiently sensitive for the colored lights.

As light filters, the following liquids were employed by Herr Hruza, a glass trough with parallel sides being used:

	Strength.
ORANGE FILTER.	
Cochineal red and aniline yellow	1 to 100.
GREEN FILTER.	
Malachite green	1 to 200.
VIOLET FILTER.	
Ethyl violet	1 to 200.

Color-sensitive gelatino-bromide plates were used for the orange and green, while a wet collodion plate serves very well for the violet.—*Photo. Work.*

How Straw Paper is Made.

A recent visit of a newspaper man to the straw paper mill at Chillicothe, Ill., results in the following description of how the paper is made, and as the method is very similar to that of making strawboard, the article will be interesting.

Through the courtesy of Mr. James Waterhouse we started at the straw pile and were conducted through the various processes to where the finished paper lay bundled for the market. The straw is conveyed on a long carrier from the straw pile to the cutter, which is run by a 25 horse power engine, and cut into small particles, then elevated to the upper story and dropped into two digesters, where it is cooked by the lime process.

These digesters are large iron tubs 24 feet long, 8 feet in diameter, and weigh 80 tons; it requires a carload of lime every week. The hot liquor cooks the straw to a pulp, after which it passes through pipes to a chest on the lower floor, and is then pumped through an eight inch pipe to the washing engine on the upper floor, then back down below to the half-finishing chest, whence it is again pumped up to the upper floor and passes through the coarse grinder and finishing engine, thence to the vat near the rollers, where the liquid is separated from the stock, which is gathered by a fine wire roller and adheres to the felt rollers, where it begins to assume shape. It then passes over a series of rollers at the rate of 96 to 120 feet per minute. It is then carried over 13 large drying rollers that are heated by steam, thence to two stacks of calenders of chilled steel, where the paper is finished and transferred to the reel stand and then passed to the cutter, where it is cut to any required size. It is then received by two boys, who carry it to the table where it is bundled, and the straw pile that you stood by six hours ago lies before you, finished goods all ready for the market.

The paper is manufactured by the Tompkins process. The mill is supplied with the latest improved machinery for making brown straw and colored express paper.

Some idea may be formed of the magnitude of this plant when you realize that the ponderous machinery for its operation weighs 1,000 tons, and requires three engines of 140 horse power to operate it, and three immense boilers to generate the steam, and still the power is insufficient. The company will place another engine of 100 horse power in the near future. The steam pump in the valley below the mill raises 500 gallons of water per minute.—*Shears.*

Sound.

Lord Rayleigh lately delivered the first of a series of afternoon lectures at the Royal Institution on sound, and said that the course he intended to adopt was to deal chiefly with those facts which admitted of experimental illustration possible to be given in public, also to deal with points of theory not obtainable in books readily accessible. He then caused a bell to ring in an atmosphere of hydrogen, when it gave a faint sound, which grew stronger as common air was made to replace the hydrogen gas. Sir John Herschel, who, said the speaker, had done such good work that his name should not be mentioned without the highest respect, had made a mistake as to the theory of this fact; he thought that as there was a mixture of gases, the hydrogen attempted to interfere with what the air wanted to do. Sir George Stokes had given the real explanation; in hydrogen the length of the sound wave is four times greater than in air, so the bell is four times smaller in hydrogen relatively to the wave length. It would seem at first sight that if a vacuum were only good enough, the sound from a bell in it would cease, but if he said so it would be wrong, for sound could be sent through the ether, in spite of the best vacuum that Mr. Crookes or Professor Dewar could produce. An experiment could be imagined in which a magnet was caused to make 100 or 200 revolutions per second inside a vacuum, and by means of a coil of wire outside connected with a telephone, the sound could be heard.

Gases are not essential for the transmission of sound. It will pass, for instance, through wood, as set forth in the following table:

Velocity of Sound in Wood.

Name of wood.	Along the fiber.	Across the layers.	Along the layers.
Pine	10,910	4,611	2,605
Oak	12,622	5,036	4,229
Elm	13,516	4,665	3,324
Poplar	14,050	4,600	3,444
Acacia	15,467	4,840	4,436

The effect of making sound pass along a bar of wood is much the same as if a speaking tube be used. For instance, 36 feet below the floor of the theater a musical box was playing, and in contact with it was a rod of wood, of which the upper end came through a hole in the floor. Whenever he put an empty box on the top of the rod to act as a sounding board, all present could hear it playing. When he removed the box the sound ceased, because without the box the greater part of the sound was reflected back again down the rod. A stretched string or wire, with a sounding board at each end, will convey sound upon the same principle.

Sounds may be classified, and those which are most suitable for investigating are musical; they can be continued with uniformity for any length of time, and present other advantages; in fact, it is only about musical sounds that much is known, exact knowledge being considerably limited to this class of sound. In musical sounds the vibrations are performed in a given time; they have the character of complete periodicity; after a certain interval of time everything occurs over again as during the first period of time. Galileo first discovered that with any particular musical sound the number of vibrations in a given time is a constant, and this is a principle of the utmost importance.

The speaker then showed that a musical sound could be produced by a sufficiently rapid succession of puffs of air; he employed a revolving disk with a horizontal axis, driven by multiplying gear; near the circumference of the disk was a series of holes at regular intervals apart, and passing close before the orifice of a pipe from which air was steadily issuing. The perforated disk moved 6¼ times faster than the handle by which the instrument was driven, so that the time of rotation of the lower wheel as compared with that of the upper wheel, combined with the knowledge of the number of holes in the latter, enabled the number of puffs of air producing any particular musical note to be counted. When another sound, made by a tuning fork, was brought to the same pitch as that given by the puffs of air, it was known that the number of vibrations of the fork in a given time was the same. He then exhibited the siren, the well-known acoustical instrument made upon the same principle, and explained its method of working.

Lord Rayleigh said that some of the most important discussions upon sound have forced upon its students the idea of "phase," which means the part of a vibration in which a body is at any particular time; for instance, the moon is a vibrating body in a sense, and we have the four phases of the moon. When two tuning forks of the same period are vibrating, so as to be in the same phase at the same time, the air is condensed and rarefied by each at the same time, and the sound is louder. When the waves made by one fork are half a wave length behind those made by the other fork, the phenomenon known in music as "beats" is produced, and this has somewhat inaccurately been called the "interference" of sound.

Platinum Prints in Sepia, Bartolozzi Red and Green Tones.

If a finished platinum print, obtained by cold development on platinotype paper, is placed in an ordinary uranium toning bath, the black color of the image will acquire a brownish violet tone, which, however, even in the case of a prolonged action of the bath, does not change into the well-known "Bartolozzi red" tone. The latter may be produced by the following method, described by Dr. Strakosch in the *Photo. Rundschau:* To 1,000 c. c. of the developing solution, which is used for platinotype paper with cold development, from 100 to 200 c. c. (in some cases even more) of a 4 per cent solution of perchloride of mercury is added. The platinotype is printed sufficiently deep when it is developed in the above developing bath. The prints will acquire in it a brown tone. After fixing them as usual in hydrochloric acid, and after they have been very thoroughly washed, they are placed in the following uranium toning bath:

Water	500 c. c.
Uranium nitrate	5 grammes.
Potassium ferricyanide	1 gramme.
Glacial acetic acid	30 grammes.

In this bath the prints will attain at first a fine sepia tone, which will gradually become more and more reddish, until at last the Bartolozzi red will be acquired. Various tones may, therefore, be produced according to the time for which the prints are allowed to remain in the bath. As soon as the desired tone is obtained the print is washed for about ten minutes in water which has been slightly acidified by acetic acid, when it is rinsed for a very few minutes with clean water. To produce green tones, the red toned prints should be treated with a dilute solution of chloride of iron. In this bath the tone will change at first into gray, then into olive green, and finally into a brighter green. The prints are then placed for a short time in water which has been slightly acidified with dilute hydrochloric or acetic acid, which will remove the excess of ferric salt. If the prints are allowed to remain for a rather long time in water which has not been acidified, they will lose their color, but in such a case the green tint can be easily restored by immersing the prints in ferric chloride solution.—*Photo. News.*

No. 999.

There can be no doubt that the world's record for fast passenger train speeds has been beaten on the New York Central & Hudson River Railroad in the wonderful run made May 9, 1893, by locomotive No. 999. On that day that engine hauled the Empire State Express from New York to Buffalo, a distance of 440 miles. The schedule of the train is, as we have very often said, 50·7 miles an hour, including four stops. The train was 28 minutes late in leaving Rochester, and ran the distance from Rochester to Buffalo, 69 miles, in 68 minutes, making up 15 minutes. In this part of the run one distance of five miles on a level grade was run in 3½ minutes, being at the rate of 86 miles an hour. This was from Looneyville to Grimesville; and one mile west of Grimesville was run in 35 seconds, being at the rate of 102·8 miles an hour. This mile was also level. The speed was taken between mile posts, by a stop watch, by the conductor of the train. The train consisted of four cars, and the weight of cars and passengers was 362,000 pounds; the weight of engine and tender was 204,000 pounds. We are indebted to Mr. Wm. Buchanan, Superintendent of Motive Power, designer of this magnificent engine, for confirmation of the particulars given above. The engine itself was shown in our issue of April 28, but we repeat below a few of its principal dimensions:

Cylinders	19 in. × 24 in.
Driving wheels	86 in.
Diameter of boiler	58 in.
Total heating surface	1,930·37 sq. ft.
Grate surface	30·7 sq. ft.
Weight, working order	124,000 lb.
Weight on drivers	84,000 lb.
Boiler pressure	190 lb.

Not the least remarkable part of this performance is that the sustained run of 69 miles in 68 minutes was made after the engine had hauled the train 371 miles; the run of five miles, at 86 miles an hour, was made after a run of 424 miles, and the mile at 102·8 miles an hour after 429 miles had been run. The best previous record of a locomotive with a train we believe to have been one mile run at the rate of 97·3 miles an hour. This was on the Central of New Jersey, and the engine was a Vauclain, four-cylinder compound.—*Railroad Gazette.*

HIRAM W. SIBLEY, of Rochester, has given to Cornell University $50,000 for the erecti n of a new building for the use of the Sibley College of Mechanical Engineering, founded by his father, who, with his family since his death, have contributed several hundred thousands of dollars. The new building will supply ample accommodations for the increasing number of students who come to Cornell University for training in mechanical and electrical engineering. The building will be completed before the opening of the university in September.