on the bottom to be crushed is made by means of a catch which permits the drill to fall, the lower part of the instrument being provided with a heavy weight. In that manner the force which is necessary to operate the auger at a depth of 2,624 feet, 2,952 feet, or 3,280 feet is no greater than at 328 feet. It is only necessary to remove the instrument from the bottom of the hole in case of some accident.

It was Œynhausen who first conceived the idea of balancing a portion of the drill, and this was the first step in the application of the free fall, which is now in use in a great number of the systems that are constantly being improved.

The instruments to be used in driving artesian wells form almost an arsenal. Our engraving (Fig. 2) reproduces the principal types of these cyclopean instruments which are used for boring, for cleaning, for extracting the rubbish, for enlarging the bore, etc.

The reader will find in the description placed under the cuts the necessary explanations. By means of samples, the large cylindrical blocks of rock which are brought to the surface, it is possible, with the help of science and past researches, to form geological charts giving the exact position of the strata traversed by the boring instrument. The drill, by alternating and repeated blows, crushes and grinds the hard rock at the bottom of the boring. The rubbish is brought to the surface by a cleaning instrument. When a friable stratum is met with, it is sustained by iron tubes, and when the artesian supply is reached) the tubes which serve to conduct the water to the surface are put in place.

The tubing is run in large iron sections, 3, 9, 12, and 7 feet in length, riveted together in such a way as to form a smooth interior bore and constitute a single rigid column from the top to the bottom of the well. The thickness of the tubes varies from 0·118 to 0·787 in., according to the diameter of the bore. It is curious to see the tubes superposed one above the other with perfect precision, while in their interior the enormous drill works with regularity and almost noiselessly. The instrument employed at the Place Hebert weighs 8,000 pounds, but those used by Mr. Lippmann in the wells at Konigsborn and Gelsenkirchen weighed 50,000 pounds. The drill is lifted from 1 foot to 1 foot and 6 inches, ten or fifteen times a minute, and falls by its own weight on to the bed, which it reduces to powder.

Sometimes accidents happen, and the tubes are crushed and flattened out at enormous depths. It is then necessary to withdraw them and bring them to the surface. It required nine years to remove tubing 328 feet long and weighing 120,000 pounds, which had been placed in the well in the Place Hebert.

Sometimes dynamite is used for breaking the formations which have defied the powerful weight of the tools, but dynamite does not act effectually at such great depths under the enormous pressure of water. Charges of 30 pounds of dynamite simply lift the column of water, and let it fall again, without accomplishing any useful end. A pressure of 2,000 feet of water or more is so great that a wisp of straw carried to the bottom of the well by the instrument, and then brought up to the surface by the cleaning device, was found twisted and contracted in such a way that it was as heavy as metal, and fell to the bottom of a dish of water like lead, although it preserved its original appearance and form.

Our other drawing (Fig. 1) represents the position of the well at Place Hebert, the surroundings of which have not yet been completed. This abundant supply of hot water throws a spout 114 feet high. The water will be conducted to reservoirs, where it will be at the disposal of factories and, perhaps, employed for private purposes. Very little remains to be done to complete this important work and to gather in the fruit of success. Science and the arts will have learned many useful and important lessons, which will be of benefit to posterity.—*La Nature.*

1. Drill, 4 feet 6 inches in diameter, having 6 arms provided with channels, allowing a free fall. This instrument is used for sinking the well and for cutting out specimens at a depth of from 1,400 to 1,800 feet. When it is desirable to remove a sample, the large transverse blade is replaced by two small ones. 2. A drum having 7 valves serving to remove the earth which has been ground by the drill with the transverse blade. 3. Drum with an interior pump. This drum serves to remove the sand which is met with at a great depth. 4. Drum composed of 8 tubes having valves at the bottom; this is used when it is desirable to remove a specimen of a stratum. It serves to clean the annular space made by drill No. 1 without the transverse blade. 5. A specimen cut out and ready to be clamped and raised by drill No. 6. 6. This tool is used for cutting the base of the specimen and removing it from the bore. 7. Machine having 8 rollers for straightening tubes of 5 feet in diameter, and for grinding up a section of tube which has been broken.

Fig. 2.—INSTRUMENTS USED FOR BORING THE ARTESIAN WELL IN THE PLACE HEBERT, PARIS.

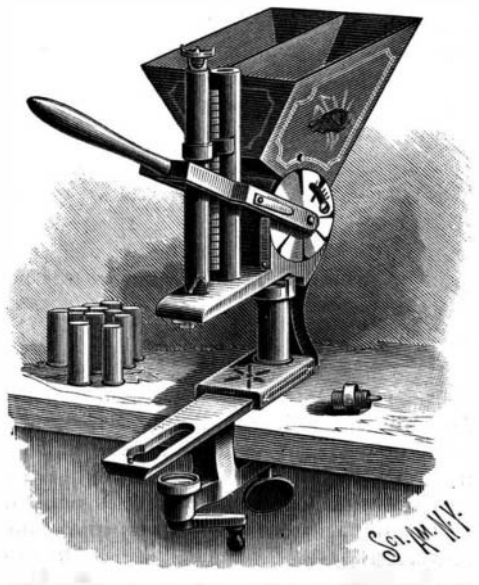
ROMER'S SAW GUMMER.

AN IMPROVED SAW GUMMER.

A saw gummer which admits of ready adaptation and quick adjustment for work on a variety of saws is illustrated herewith, and has been patented by Messrs. John P. and Nicholas Romer, of Gowanda, N. Y. To the side faces of the lower portion of the body are riveted upwardly extending diagonal plates, above which is adjustably held a die holder, the adjusting screws holding the die in any desired position, while the die rests directly on the upper endsof the diagonal braces. In the die is formed a V-shaped opening corresponding with the desired interdental spaces of the saw. Side plates are secured above the die, between which is mounted a movable bar, the lower end of which is formed to correspond with the opening in the die, the bar being normally upheld by a spring. Above the bar is a double-faced eccentric, having a rigid handle made integral therewith, the eccentric being pivotally supported by a bolt extending through the upper portions of the side plates. A bracket is adjustably connected to the right hand side of the body, so that it may be moved toward or from the front of the gummer, the bracket forming a support for a gauge, upon the point of which is a toe to enter the recesses between the saw teeth and regulate their size and slant as they are formed by the gummer. The construction is such that the gummer may be readily secured to a bench or other stationary support, and allow the saw body to be swung over the bench when the dies are used for shearing, giving a greater range of motion than would be possible if the gummer were supported at points above the die.

AN IMPROVED CARTRIDGE LOADER.

A combination tool for loading the ordinary form of paper shell cartridges, and which will load both No. 10 and No. 12 shells, is illustrated herewith, and has been patented by Mr. Francis P. Devens, of No. 1306 Forest Avenue, Kansas City, Mo., the invention covering an improvement on a cartridge loader by the same inventor described in our issue of April 21. Upon the main standard is mounted a cylinder, above which is a centrally divided hopper, with one compartment for shot and the other for powder, the internal mechanism of the cylinder being such that, by the raising of the bifurcated lever a certain distance, a regulated discharge of powder will be effected and, the lever having been lowered and again raised in like manner, a similar discharge of shot will be made. The base of the shell tube is adapted to slide on a plate extending forwardly from the clamp, and having an elongated aperture, through which the shell to be filled is passed into the shell tube, the latter being then moved to the position beneath the hopper where it is shown in the illustration. The powder having been supplied, the tube, as it is drawn forward, engages a tongue at the lower end of the wad tube, whereby a wad is placed on the powder, and the shell tube with its partially filled cartridge is moved further forward to a position just beneath the plunger, when a depression of the lever forces the wad home upon the powder. The same operation is then repeated in loading the shell with shot. A capping and decapping device, adapted to screw into the lower end of the plunger, has a convex face on one end for capping and a pin projection on the other end to remove an exploded primer. The crimper, beneath the forward end of the clamp plate, has an annular groove



DEVENS' IMPROVED CARTRIDGE LOADER.

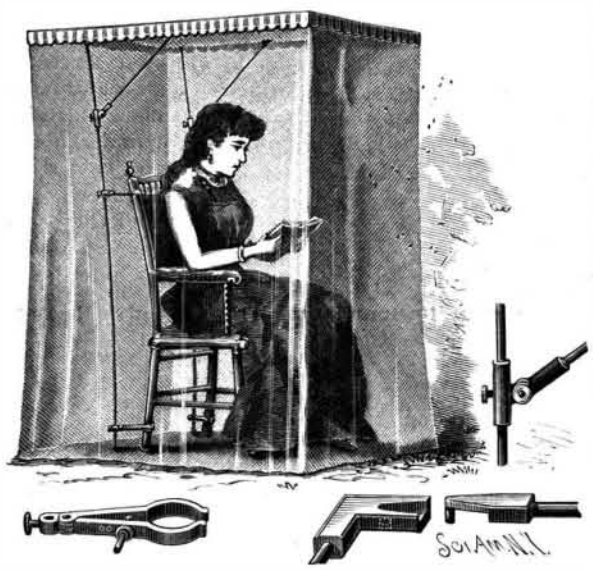
in its upper face, its lower edge being formed of cam faces, operated by a crank arm. The open end of the cartridge is first depressed by a claw or pronged piece adapted to engage with the thread of the plunger, so that it will enter the annular groove in the upper face of the crimping block, when by a slight downward pressure on the lever, at the same time rotating the crank arm, the edge of the shell will be further turned over and properly crimped.

Photography as a Detective.

Photography is gaining prominence in the criminal courts. With its help a Berlin merchant was lately convicted of crooked ways in keeping his accounts. The slightest differences in color and shade of inks are made manifest in the photographic copy. Blue inks appear nearly white; brown inks, on the contrary, almost black. A contemporary states that the books of the accused were submitted to a photographer, who took off the pages concerned and brought into court the most undoubted ocular proofs of the illegitimate after-entry of some of the accounts. A subsequent chemical test substantiated this evidence. The photographic is to be preferred to the chemical test, because it brings its proofs into the court, and submits them to inspection, at the same time leaving the document under examination unharmed; while the results of a chemical test must be taken on the evidence of the chemist alone, and the writing examined is perhaps destroyed. In another case similar to the above, the changing of the date of a note by an insignificant erasure and addition was proved by means of photography.

AN IMPROVED CANOPY DEVICE FOR CHAIRS.

A frame to support an awning, canopy, or mosquito netting, which can be quickly and easily secured to



SMITH'S CANOPY ATTACHMENT FOR CHAIRS, ETC.

and detached from a chair, settee, etc., and is especially designed for use as a screen for protection against mosquitoes, etc., at all watering places and mountain resorts, is illustrated herewith, and has been patented by Miss Almira A. Smith, of Hadley, Mass. (box 140). The frame proper is composed of two standards, two side pieces, two end pieces, and two braces, which may be made of wood, but are preferably nickel plated metallic rods.

The standards are adapted to be detachably secured to a chair or settee by means of clamps, such as shown in the small figure to the left in the illustration, the small figures to the right showing corner pieces of the top frame, and the manner of adjusting the braces on the standards. An awning cloth of waterproof material is attached to the top frame, and, when used in localities infested with mosquitoes, a suitable netting is suspended in such manner as to wholly inclose the space beneath the frame. The construction is such that the frame can be accommodated to any irregularities of the ground, and the whole can be quickly taken down and folded in compact form to be readily carried in the hand of the user.

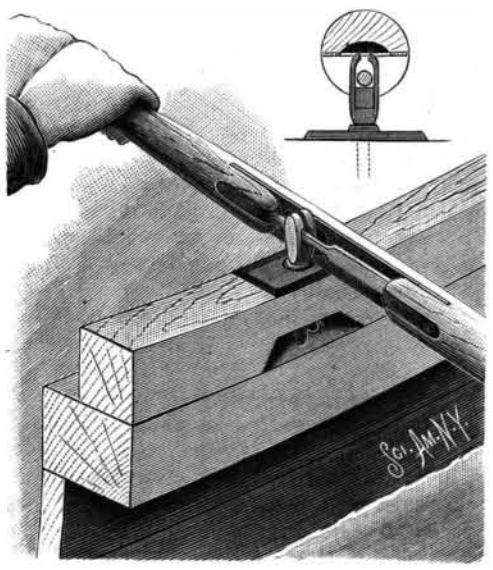
The Hoosac Tunnel, North Adams, Mass.

The total length of the tunnel is 25,031 feet, or four and three-fourths miles. It is 20 feet in height and 24 feet in width. From it was excavated 1,900,000 tons of rock. Its entire cost was $14,000,000. It is soon to be lighted by electricity.

THE SCIENTIFIC AMERICAN needs no one to "sing its praises," but, notwithstanding this fact, we feel it an absolute duty to the general public, at least that portion of it which has never seen or heard of the paper, to tell them that such a one is published at the low price of $3 a year, and that its true value cannot be overestimated. It stands at the head of all publications of its kind.—*Amer. Art Printer.*

AN IMPROVED OAR AND OAR LOCK.

A novel construction, whereby an oar will be held securely in the oar lock, while turning freely therein, forms the subject of a recent patent, and is illustrated



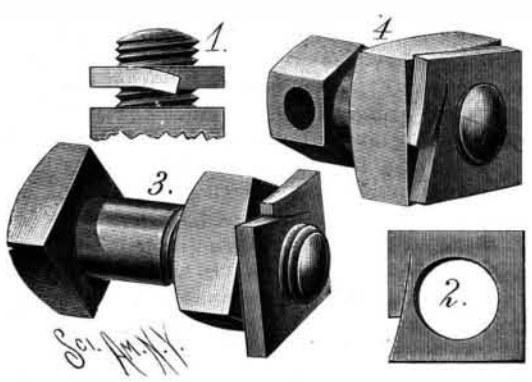
PHEATT'S OAR AND OAR LOCK.

herewith, the small figure showing a sectional elevation of the oar and oar lock. In a space formed by a cut-away portion of the oar is fixed a metal rod to fit in the oar lock, this rod being so attached that there will be no projections on the oar. At the bottom of the space formed by cutting away the oar is fitted a strengthening plate. The rod is round for about half of its length, the other portion being flattened to adapt the rod to be readily placed in and removed from the narrow slot or opening of the rowlock, which is formed with a shank that enters the rail, and a plate secured thereto in the usual manner. The top of the lock is divided to form two opposite members, between which the rod is held to fulcrum the oar, the upper ends of the members approaching each other at the top to form a narrow slot. The oar is limited in its outward movement, and in reversing the direction of rowing, it has simply to be turned over the top of the lock.

For further particulars with reference to this invention, address the inventor, Mr. Gideon K. Pheatt, of No. 120 Locust Street, Toledo, Ohio.

AN IMPROVED NUT LOCK.

A nut lock which partakes of the functions of a jam nut, and which may in some instances take the place of a nut already in use, is illustrated herewith, Fig. 2 showing a plan view, and Figs. 1, 3, and 4 illustrating different applications. The invention consists in a nut whose inner periphery is threaded, and whose body portion is cut entirely through with a slit parallel to the axis of the bolt, a portion of the body thus cut being depressed or pushed out of the normal plane of the nut, so as to act as a stout spring bearing against the other nut when screwed up. The tension of this spring, when the jam nut is screwed up, creates so much friction that neither of the nuts can turn without turning the other, while the strain is so unequal as to prevent them from acting in unison. The cut in the jam nut may also be semicircular, or nearly so, terminating at either end in the body of the nut, and not extending to the edge. This invention was patented in December, 1886, and the nut has been thoroughly tested and has given satisfaction. For



VAUGHAN'S NUT LOCK.

further information relative thereto address the Vaughan Manufacturing Co., No. 41 South Front Street, Philadelphia, Pa.

Annealing Small Tools.

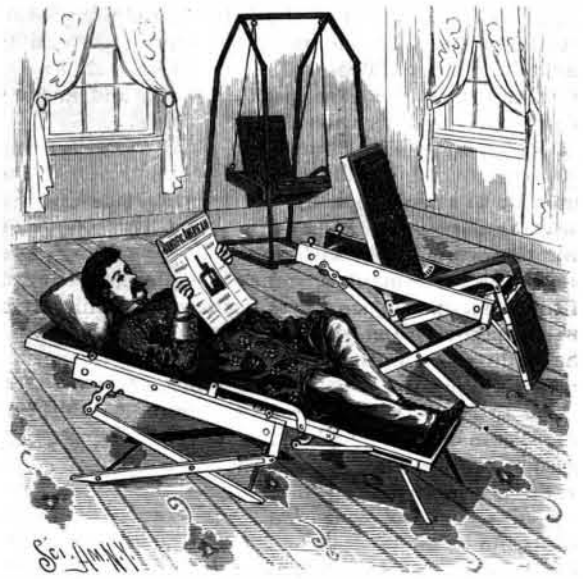
According to the *English Mechanic*, a very good way to anneal a small piece of tool steel is to heat it up in a forge as slowly as possible, and then take two fireboards and lay the hot steel between them and screw them up in a vise. As the steel is hot, it sinks into the pieces of wood, and is firmly embedded in an almost air-tight charcoal bed, and when taken out cold will be found to be nice and soft. To repeat this will make it as soft as could be wished.

Paper for Cleaning Lenses.

Prof. S. H. Gage, of Cornell University, recommends, as preferable to linen or chamois skin, the so-called Japanese filter paper, the bibulous paper often used by dentists in filling teeth. It is soft and flexible, absorbs liquids readily, is less likely to contain gritty particles that are liable to scratch the lenses, and it is so inexpensive that when a piece has once been used it may be thrown away. Every director of a microscopical laboratory appreciates the difficulty of getting students to exercise the proper care in cleaning objectives and eye pieces. Every large laboratory is sure to contain some students whose genius for scientific study is exhibited chiefly in the careless handling of delicate apparatus. Doubtless if in a microscopical laboratory each student were provided with a quantity of this paper, fewer valuable lenses would be injured.

AN IMPROVED ADJUSTABLE CHAIR AND SWING.

A chair, in which the position of the back seat and foot rest may be changed at pleasure, and the chair be readily varied in height as desired, while it may also be quickly transformed into a couch, or adapted for use as a swing, forms the subject of a recent patent, and is illustrated herewith. Besides a main frame of novel construction, three separate frames are provided, constituting respectively the back, seat, and foot rest, hinged together, the seat being adapted to fold upon the back, and the foot rest upon that side of the seat not in contact with the back. There is a crank to make continuous the reclining action of the back and seat, whereby also the foot rest may be made to work in unison with the back and seat, or be released to fold under the seat. The foot rest is also detachable, so that it can be placed out of the way without inconvenience to the user. The normal height of the chair may be lowered to that desired for a lady's sewing chair, retaining the reclining position, and, with



BASTIAN'S ADJUSTABLE CHAIR AND SWING.

the extension of the foot rest, the chair may then be made to form a couch. Discarding the legs by folding them underneath the frame, provision is made to use the contrivance, suitably hung, as a swing, which will be comfortable and secure, and peculiarly adapted for children's use. As is obvious, the construction, as a chair and chair and swing, presents facilities for a great variety of changes. Entirely folded up, it forms a rectangular package of small compass capable of easy transportation and storage.

For further particulars with reference to this invention, address the patentee, Mr. Charles Bastian, No. 36 Howard Street, New Orleans, La.

The Electro-Crystallization of Metallic Copper.

BY H. N. WARREN, RESEARCH ANALYST.

The apparatus made use of for the above mentioned substance consists entirely of an open tube, closed at one extremity by means of a bladder diaphragm, and suspended in a solution of dilute sodium chloride. Into the tube is introduced a saturated solution of cupric sulphate, the strength of the solution being maintained by the insertion of a smaller tube terminating in a point, and containing crystals of $CuSO_4$. A strip of copper foil, about 3 inches long by 1 inch wide, is next introduced into the copper solution, and connected by means of a copper wire to a plate of zinc, forming the negative electrode and in contact with the salt solution. After the lapse of a few hours small cubical crystals of metallic copper gradually begin to appear on the copper electrode, which in the course of a week or more will have arranged themselves into a compact crystalline mass, possessing a full metallic luster, and rivaling in purity and malleability the finest specimens of native copper, which they much resemble. Metallic silver, antimony, bismuth, zinc, and even aluminum, magnesium, iron, chromium, and all the more oxidizable metals, may by slight alterations be reduced to the metallic state.—*Chemical News.*