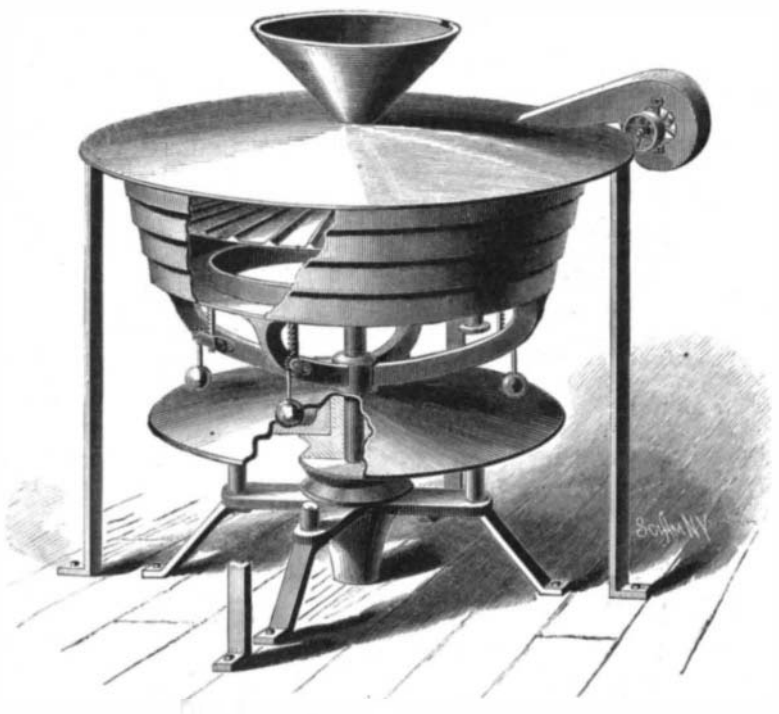
NEW GOLD SEPARATOR.

The rotary shell of the gold separator shown in the engraving is made with annular offsets upon its inner surface to facilitate the support of the mercury upon the inner surface of the shell. The base flange of the shell is provided with a movable rim, having racks and pinions for raising and lowering it, so that the height of the rim may be graduated to the amount of mercury on the flange; this rim is lowered automatically by means of the weighted arms thrown out by centrifugal force, which also causes the mercury to pass up the inner surface of the shell. The vertical drive shaft is provided with a pulley, and carries the distributer on its upper end. In using the separator mercury is placed in the ring trough at the bottom of the outer shell, and as the shell is revolved the mercury is driven up its inner surface by centrifugal force, the ascent of the mercury being facilitated by the offsets of the outer shell, the mercury being supported by centrifugal force, the flare of the shell, and the off-sets or steps. As the sand is introduced into the machine by the fan blower it falls upon the conical grooved distributing plate; it is evenly distributed by centrifugal force against the coating of mercury spread over the inner surface of the outer shell, and the particles of gold in the sand will be taken up or amalgamated by the mercury, while the sand slides down the inner surface of the outer shell and over the upper edge of the movable rim. As the sand falls from this rim it is received upon the conical discharge plate below, and is thrown out of the machine by centrifugal force. It is claimed that by this construction every particle of gold will be withdrawn from the sand and held by the mercury, while the sand is discharged freely from the machine.

This invention has been patented by Mr. Horace E. Henwood, of Kansas City, Mo.



HENWOOD'S GOLD SEPARATOR.

New Disinfectant.

Professor Carlo Pavesi, of Italy, proposes as an improved disinfectant a solution composed of chloride of lime, camphor, and glycerine. This mixture is capable of being used in all cases in which phenic acid is now employed, and its odor is less disagreeable, less irritating, and less toxic than that of the latter. It is said to at once arrest the putrefaction of animal bodies, and is highly commended by the *London Medical Record.*

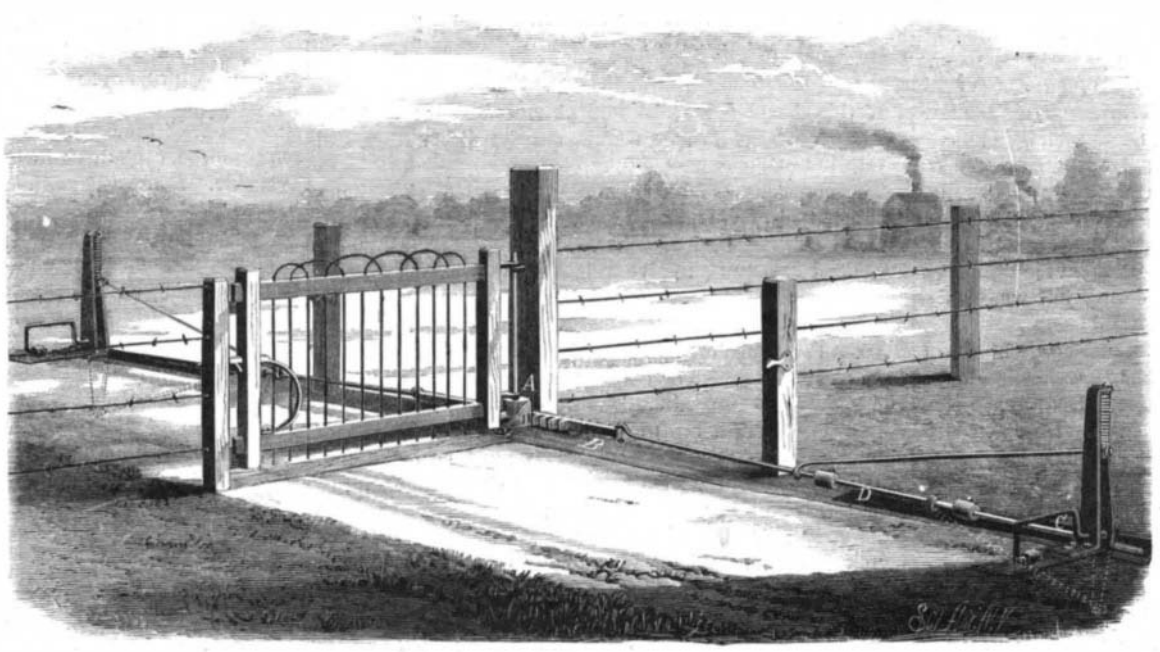
IMPROVED AUTOMATIC GATE.

This gate is opened and closed by the vehicle which passes through it without compelling the driver to alight. It is an improvement upon the form of automatic gate in which a sliding toothed bar acts upon a set of segmental teeth connected with the gate post to open or close the gate by the longitudinal movement of the sliding bar, the latter being actuated by rods on opposite sides of the gate connected with double-cranked shafts that are struck and deflected by the vehicle wheels.

To each end of the sliding toothed bar, B, is attached a horizontal rod, D, which is arranged in guides on the bed frame so as to have a free longitudinal movement. These rods extend at right angles to the closed position of the gate. Near the ends of these rods, on each side, is arranged a crank shaft, C, whose looped or cranked portion is normally held in a vertical position, so as to be struck and turned down by a vehicle wheel. On the other end of this crank shaft (on each side of the gate) is rigidly secured a lever, which is fastened about its middle to the shaft, and which lever, together with the bend of the crank shaft, is held in vertical position by a spiral spring attached to the top of the lever at one end and to the top of a vertical bar at the other. This spring will be housed in a suitable case or tubing. From the opposite ends of each lever pull rods extend, both terminating in their ends next to the gate in eyes that loosely encircle the main rod, D.

On the main rods, D, are stop blocks, against one of which the upper pull rod pulls when the crank shaft is deflected in one direction. When the crank shaft is deflected in the other direction the lower pull rod is operative. In operating the gate automatically by the passage of the vehicle, it will be seen that when the wheels of the vehicle strike the first crank shaft and deflect it toward the gate the lower pull rod pulls on the stop block, and the toothed bar is pulled toward the vehicle, turning the toothed wheel which carries a cam in which a roller attached to the gate rests. This raises the gate bodily until the latch is released, when the roller rolls down the incline of the cam, and the gate is opened by its own gravity. Closing the gate is simply the reverse of this operation. The gate operates in the same way when approached from either direction, and it may be opened by hand whenever necessary.

It will be seen that as all of the strain on the toothed bar is a pulling strain the rods may be made very small, like wires, or even chains or other flexible connections might be used.



NEW AUTOMATIC GATE.

This useful invention has been patented by Messrs. J. Austin and R. Chamberlain, of East Liberty, Ohio.

Lightning Rods.

A meeting was recently held at the rooms of the Meteorological Society, London, at which delegates were present from the Royal Institute of British Architects, the Physical Society, and the Society of Telegraph Engineers, to consider the desirability of issuing a code of rules for the erection of lightning conductors. After discussion, a set of rules was promulgated, in which it is set forth that "the rod should not be bent abruptly around sharp corners, and in no case should the length of the rod between the points be more than one and a half times as long as a straight line joining them. Where a string course or other projecting stonework will permit, the rod may be carried through instead of around the projection." In keeping with this, "the rod is not to be kept from the building by glass or other insulators, but attached to it by metal fastenings. Rods should, preferentially, be taken down the side of the building which is most exposed to rain. They should be held firmly, but the holdfasts should allow for contraction and expansion."

This non-insistance on insulation, as to lightning rods, is to many persons strange, as adequate insulation is required for the safe use of electric-light wires. Lightning will always follow directly the best—not necessarily the shortest—conductor, in its passage to or from the earth; to use a figurative expression, it may be said *not to have time* to turn off at right-angles from a metal rod, properly joined and continuous, to enter a building. While, however, the lightning flashes instantaneously through the rod, and the quicker it passes the better, the electricity passes as a steady, constant stream to the carbons of lamps, and thence to the earth. There may be said to be a kind of "storage" of it in the wires, through its being allowed to pass only as it can inflame the carbon points of the arc light, or render incandescent the slender carbon thread. In the case of the rod, insulation as a resistant is to be first considered; in the case of the wire, insulation as a non-conductivity is the chief point.

NEW INVENTIONS.

A novel thill coupling has been patented by Mr. Elias Hoxie, of Red Creek, N. Y. This invention consists of an adjustable brace, secured to the under side of the thill and to the bolt by which the coupling is accomplished, the object being to prevent noise by the rattling of the parts against each other.

It is desirable that the covers of jars of pickle casters and analogous articles of table ware shall be permanently connected with the caster, so that they may not become misplaced or lost and yet be capable of being removed from and replaced on the jars quickly and conveniently. Mr. Thomas Leach, of Taunton, Mass., has devised an improvement in which the cover is attached to a curved or crank rod, that is adapted to slide vertically in a tubular guide forming a fixed portion of the frame of the caster and located above the jars.

Mr. James F. Edwards, of Washington, D. C., has patented an angle brick for bay windows and other obtuse-angled structures, in which the bricks at the angle shall be substantially tied with lap joints, and in which all cutting of brick is avoided, while the angle may be changed as desired.

A novel barber's paper clip has been patented by Mr. Moses Cohen, of Hallettsville, Texas. This invention relates to clips for holding slips of paper upon which razors are to be wiped in shaving the beard. It is formed by doubling upon itself a strip of metal, preferably spring brass, in such a manner that the central bent portion shall serve as a spring to hold the two straight portions in contact with each other.

Mr. Lloyd W. Gates, of Calhoun, Ky., has patented an improved car coupling the principal features of which consist of a concentric coupling hook, which is adapted to engage with a link automatically.

An improvement in hydraulic elevators has been patented by Mr. Charles T. Widstrand, of Minneapolis, Minn. This invention consists in an elevator provided with a hydraulic rotary engine, pressure wheel, or pump having an inlet pipe leading to one side of the pistons and an outlet pipe leading from the opposite side, a reservoir communicating with the outlet pipe, and an induction valve located between the pipes, and which is adapted to connect them with each other, so that the cylinder may be kept full of water, and the descent of the cab regulated by the free or retarded circulation of the water through the port of the induction valve.

Mr. Thomas N. Lupton, of Winchester, Va., has patented an improvement in shutter workers for moving and locking an outside shutter from inside the sash. The shutter is operated by a horizontal bar extending through the side facing of the window, and connected with a lever which moves above a toothed sector into which it locks to secure the shutter in the required position.

Mr. John G. Trenear, of Huntington, W. Va., has patented an improved mode of ventilating sewers and traps by which all gas will be removed from the sewer by passing through a vertical pipe into an air pipe, and thence to a furnace, where the gas is consumed. If any gas passes up through the lower end of the waste pipe, it will pass thence through another pipe into the air pipe and be carried thence to the furnace and consumed.

A novel agitator or egg beater has been patented by Mr. Gus. W. Richardson, of Hill Grove, Ky. This is an ingenious arrangement of a hollow cover apertured on its sides and inclosing a set of agitating wheels, by which the eggs are rapidly and thoroughly beaten.

Mr. George F. Goodell, of Fulton, Ill., has patented a calendar adapted for continuous use for indicating days and months, and also for finding the day of the week and months of years past, present, and future. This invention consists in the combination of changeable week and month rollers and a calendar card having upon it a monthly calendar and a key calendar for use in setting the rollers.

Magnetic Iron Ore Sands in the Forge Fire.

In a paper read before the U. S. Association of Charcoal Iron Workers, at Ironton, October 12, 1881, Mr. M. Hoagland, of Rockaway, N.J., gives the following interesting facts.

At the Rockaway Rolling Mill, in New Jersey, four Catalan forge fires are in operation, making charcoal blooms from black magnetic sand, and a very superior article is produced for steel purposes. The product is largely used by the Sanderson Brothers Steel Company, at Syracuse, N. Y., and it is found that crucible steel made from this mineral sand is superior to anything yet produced from any other American iron; in fact, equal in every respect to steel made from the best brands of Swedish iron. The steel made from this sand has been thoroughly tested for cold chisels, turning tools, and miners' drills, and in every instance has given entire satisfaction. The ore is treated by the Wilson process of deoxidizing, and afterward worked in the usual way in the Catalan forge. The deoxidizing, it is claimed, saves one half the charcoal, or, in other words, it takes only one half as much coal to make a ton of iron by the Wilson process as is used in the old-fashioned fires. The waste heat from the fire is used for deoxidizing the ore. It was found difficult to work this black sand, on account of the large percentage of titanic acid it contains, until they adopted a method of clearing it with a powerful magnetic machine invented by C. G. Buchanan, and manufactured by M. H. Hoagland, of the Union Foundry. The machine separates the magnetic sand so thoroughly that none of the titanium is found in the portion which passes over the magnet; in fact, where properly managed, the product of the machine will yield by analysis 71 to 72 per cent of metallic iron.

The results of the separation have been so satisfactory that parties who have other ores than black sand have adopted machinery invented by Mr. Buchanan to reduce their ores to a fine consistency, separating by the magnet, preferring the magnetic process, because the fine ore which is washed away by the jigging process is all saved, the magnet taking out nearly all the ore, leaving less than two per cent in the tailings. Another set of this machinery is to be put in operation as soon as it can be built, at Elizabethport, N. J., where the Wilson process will be used, producing iron by the direct method, using petroleum as fuel in puddling furnaces.

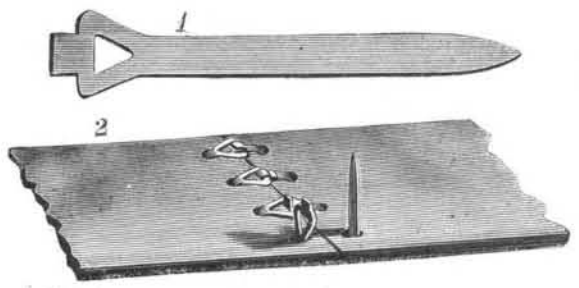
Printing Ink.

The base of our common printing ink, as is well known, is a linseed oil varnish, which sometimes possesses a disagreeable odor, and the ink made from it smells so badly as to make a freshly-printed paper an unpleasant companion for sensitive nostrils. Dr. Brackenbusch, of Berlin, proposes to overcome this disadvantage by replacing the linseed varnish with a solution of colophonium (rosin) in paraffine oil. He dissolves 45 parts of fine rosin in 25 parts of paraffine oil by heating them to 80° C. (176° Fah.) or by mixing them with a machine at ordinary temperature. When the solution is effected, if such it may be called, 15 parts of soot or lampblack are added.

NOVEL BELT FASTENER.

The engraving shows a simple, easily applied belt fastener, recently patented by Mr. Alfred H. Noble, of New Milford, Conn. The fastener is cut from a sheet of brass, as shown in Fig. 1, and has an open head or eye, a tongue or shank projecting therefrom and capable of being inserted through holes in the meeting ends of a belt and through the head or eye, and folded over. A lip projecting from the head or eye opposite the tongue is folded over the tongue to hold it down. The form of the fastener is shown in Fig. 1. The various steps in the operation of fastening the belt are shown in Fig. 2.

The first fastener is shown as merely inserted in the holes in the adjoining ends of the belt. In the second fastener the tongue is drawn through its hole in the head of the fastener, and is bent upward at right angles and cut off at the required length. In the third fastener the tongue is bent



NOBLE'S BELT FASTENER

down on the lip projecting from the head, and in the fourth the lip is bent over the end of the tongue.

This fastener, besides being simple and easily and quickly applied, is cheap and strong, having all of the advantages of the best leather lacing with none of its defects.

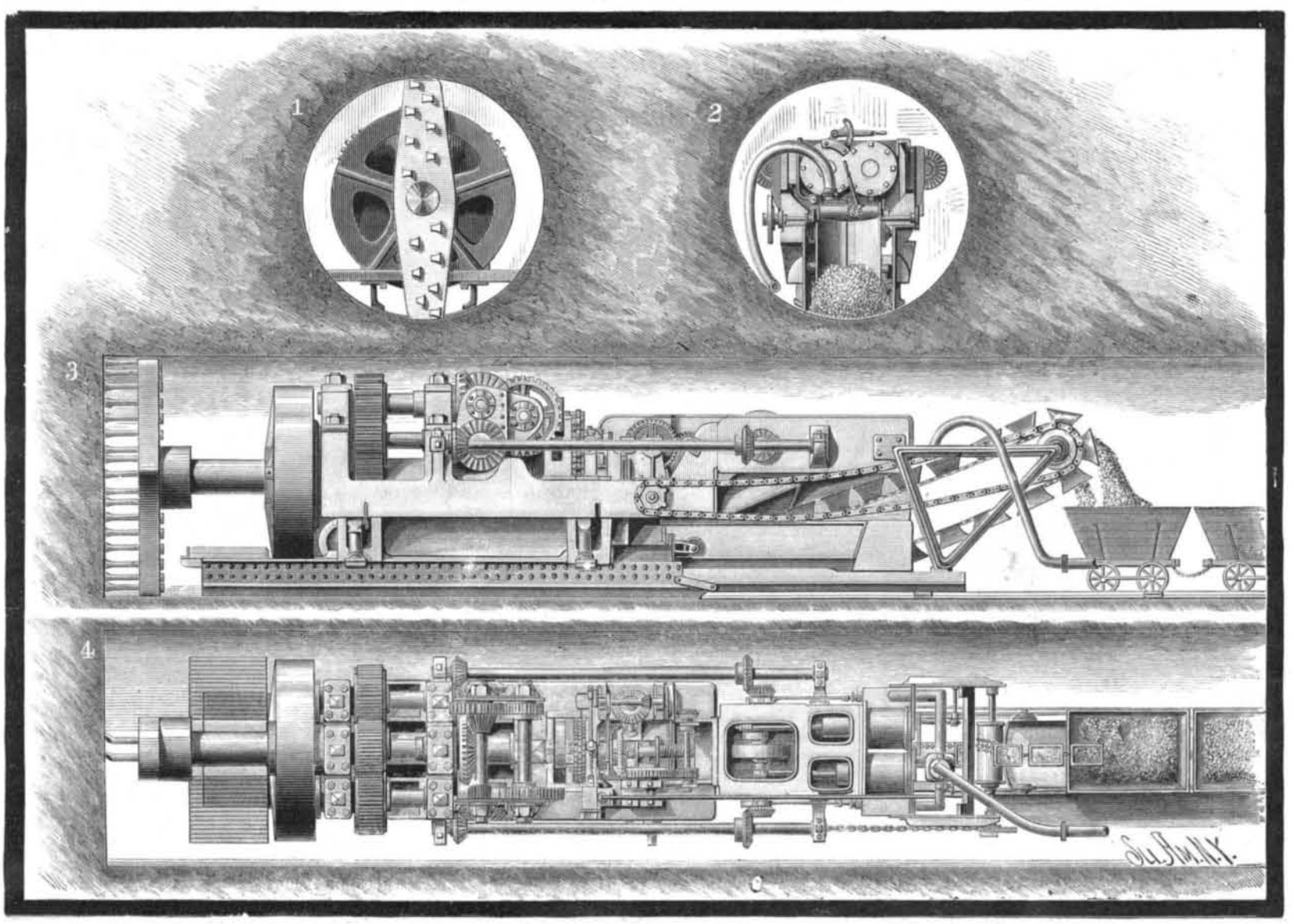
Further particulars may be obtained by addressing the inventor, or Messrs. Greene, Tweed & Co., 118 Chambers street, New York city.

COMPRESSED-AIR MACHINE USED IN THE CHANNEL TUNNEL.

The length of the Submarine Continental Railway Company's Tunnel, under sea, from the English to the French shore, will be twenty-two miles; and, taking the shore approaches at four miles on each side, there will be a total length of thirty miles of tunneling. The approach tunnel descends from the daylight surface by an inclosed gallery, with an incline of 1 in 80, toward Dover, to a point on the Southern Railway Company's line, about two miles and a half from Folkestone. The exact point is at the western end of the Abbot's Cliff tunnel, at which point the gault clay outcrops to the sea level. Half a mile of heading has been driven, by machinery, from this point; after which the works were suspended to enable them to be resumed at a point nearer to Shakespeare's Cliff, where the tunnel passes under the sea. The shaft at this point is 160 feet deep. It is sunk close to the western end of Shakespeare's Cliff. The shaft passes through about 40 feet of overlying *débris;* it then just touches the white chalk, which is pervious to water, after which it goes down to the beginning of the tunnel, which is here 100 feet below the surface of the sea. A heading, now three-quarters of a mile long, has been driven in the direction of the head of the Admiralty Pier, entirely in the gray chalk, near its base, and a few feet above the impermeable strata formed by the gault clay. The idea of the projectors is so to localize the tunnel, not only in the part already made, but also when it passes out under the sea, that it shall have the body of the gray chalk above it, and that of the gault clay below it, both these strata being in themselves impervious to water, and both alike having heavily watered strata on each side of them; namely, the white chalk above the gray chalk, and the lower greensand below the gault clay. This condition, together with that of providing sufficient roof between the top of the tunnel and the sea, which roof has a thickness of 150 feet, will necessitate the tunnel being turned in a curved line.

The present heading is 7 feet in diameter. Machinery is being constructed by which this 7 foot hole can be enlarged to 14 feet, by cutting an annular space, 3 feet 6 inches wide, around it. This will be done by machinery similar to that already described, but furnished with an upper bore head, suitable for dealing with chalk, to make an annular cutting, instead of acting like the first machine, which makes the 7 foot cutting. The one machine will follow the other, at a proper interval; and the *débris* from the cutting by the first will be passed out through the second machine. The compressed air, likewise, which is necessary to work the advanced machine, will be similarly passed through the machine coming behind. There will be no difficulty in speeding the machines so that they shall work along the tunnel at the same rate of progress; and the larger machine can, as well as the smaller one, do its work with a minimum of manual labor; only two men are at present needed for each machine.

The engraving shows the Beaumont & English compressed-air boring machine at work. The length of this machine from the borer to the tail end is about 33 feet. Its work is done by the cutting action of short steel cutters fixed in two revolving arms, seven cutters in each, the upper portion of the frame in which the borer is fixed moving forward five-sixteenths of an inch with every complete revolution of the cutters. In this way a thin paring from the whole face of the chalk in front is cut away with every turn of the borer. A circular tunnel is formed having a diameter of 7 feet. A man in front shovels the crumbled *débris* into small buckets, which, traveling on an endless band, shoot the dirt into a "skip" tended by another man. The skip, when filled, is run along a tramway to the mouth of the shaft. At present these trolleys, each holding about one-third of a cubic yard, are drawn by men, but before long it is hoped that small compressed air-engines will be used for traction. The rate of progress made with the machine is about one



BEAUMONT & ENGLISH'S COMPRESSED-AIR TUNNELING MACHINE EMPLOYED IN THE CHANNEL TUNNEL.