

New Coral Theory.

Prof. Alexander Agassiz arrived at San Francisco from Honolulu, February 12. He has spent several months in the South Sea, mainly devoting his time to the study of coral animals. Both Darwin and Dana held that coral is made, sinks and is replenished on the surface. This they taught continued indefinitely, and this process was called the theory of subsidence. Prof. Agassiz now believes that coral is a comparatively thin crust formed upon a mountain that has been submerged or upon a volcanic pile, and in nearly every case where the borings have been made the coral has been found to be shallow. In a few places where it seems to have a depth that might sustain the theories of Darwin, Prof. Agassiz proves that material into which the deep borings are made is lime of a former age of the earth. He shows that the admixture of sand with the coral establishes the surface or shallow reef. The foundation for coral in every instance has proved it to be of such material and of such shape as to warrant the conclusion that the coral is a cap to submerged mountains and volcanic upheavals.

ELECTRIC TOWBOAT IN A SEWER.

The city of Worcester has a large sewer 18 feet wide and 13 feet high. The sewage of the city is treated chemically to render it fit to flow back into the Blackstone River, so that it is desirable to separate the storm water from the sewage to lessen the expense of the chemical treatment. In order to accomplish this end a smaller sewer, 6 feet wide and 4,000 feet long, is being built inside the larger one, utilizing the bottom and one of the sides of the sewer. A cofferdam is constructed to enable the other wall of the sewer to be built, and in order to deliver materials to the workmen an electric scow was rigged up, which has been found very satisfactory. Electricity is also used to light the sewer, to operate ventilating fans and to work electric pumps. All of the lighting and power are generated on the premises in a small building outside the sewer. About midway between the ends of the sewer a small dock has been constructed and the materials are delivered to it by an incline through a hole made in the top of one wall.

The towboat is a catamaran 22 feet long and 5 feet wide. Each of the small boats is 18 inches wide. In the middle of the catamaran is a small paddle wheel box which is to prevent splashing. This is driven by means of sprocket wheels and chains which are connected with an electric motor of 2½ horse power. At the stern end is a rudder and controller, so that one man can operate both. Only one electric boat is used. It tows six scows, which have already handled 12,000 bricks, 50 barrels of cement and 100 barrels of sand daily. The double trolley system is used, the wires being hung from insulated brackets secured to the top of the arch in such a way that a trolley can be run on it. A scow is also fitted with a centrifugal pump which is used for pumping out the cofferdam, and it is driven by another motor of 14 horse power. The application of the electric towage to sewer construction is novel and the results obtained are most satisfactory.

The electric scow was designed by Mr. Harrison P. Eddy, Superintendent of Sewers, Worcester, Mass. Mr. Robert N. Kendall is the assistant in charge of the electrical work.

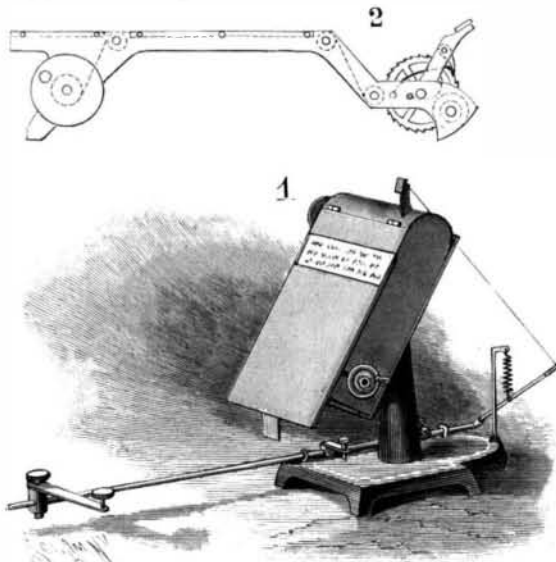
The X Rays in the Silk Culture.

The masculine silk cocoon yields more silk than that of the feminine; hence for raising purposes such varieties as give more masculine eggs are by far preferable. Up to the present it was not easy to distinguish the masculine from the feminine cocoons; the distinction was solely based on the greater weight peculiar to the feminine cocoon. The X rays have greatly facilitated

the distinction. On account of containing the unripe eggs rich in mineral salts, the hind part of the feminine cocoon is found to be by far less transparent than that of the masculine. The dark shade in the vicinity of the ovary admits of readily recognizing the feminine silk chrysalis.

AN IMPROVED COPY-HOLDER.

The accompanying illustration represents a copy-holder designed to facilitate the taking of notes, and afterward holding the paper on which the notes are written in convenient position for transcribing, the



PAXTON'S COPY-HOLDER.

paper used being in the form of a continuous web. The improvement forms the subject of a patent issued to Elmer E. Paxton, of Honolulu, Hawaii. Fig. 1 represents the device in use. Fig. 2 showing a view of one side of the paper-carrying frame, which is held in a sheet metal casing, with a cover plate that is movable to provide a large or small space for the writing, the paper being advanced by a lever or by thumb wheels as desired, and the plate affording a rest for the arm. For conveniently retracting the web when the notes are to be transcribed, means are employed in connection with a base on which is a column carrying a flanged supporting plate on which the casing of the paper-carrying frame rests. In bearings on the base is a rock shaft on whose forward end is an arm adapted to extend near the keyboard of the typewriter, while the opposite end of the shaft carries an arm to which is attached a retractile spring, and which is also connected by a cord with the free end of a lever projecting from the upper end of the casing, so that by rocking the

Sensationalism, not Science.
Scientific discoveries . . . have often been so wonderful in character that it ought not to excite surprise to find intelligent people ready to accept without question announcements of inventions and discoveries of the most improbable and absurd character. Along this line the evil influence of a sensational press is enormous. It was bad enough ten years ago, but it has been greatly magnified by the recent, and, on the whole, unfortunate cheapening of processes of illustration, to the seductions of which nearly every newspaper in the land has yielded.

To this has been added the newspaper "syndicate," by which men who know really nothing of science are employed to furnish sensational articles on scientific discovery, illustrated by sensational pictures, all of which is the more injurious because often founded upon a slender, microscopic tissue of fact. Unfortunately, some men who may be said to inhabit the fringe of genuine scientific activity lend themselves to this sort of thing and are made much of accordingly.

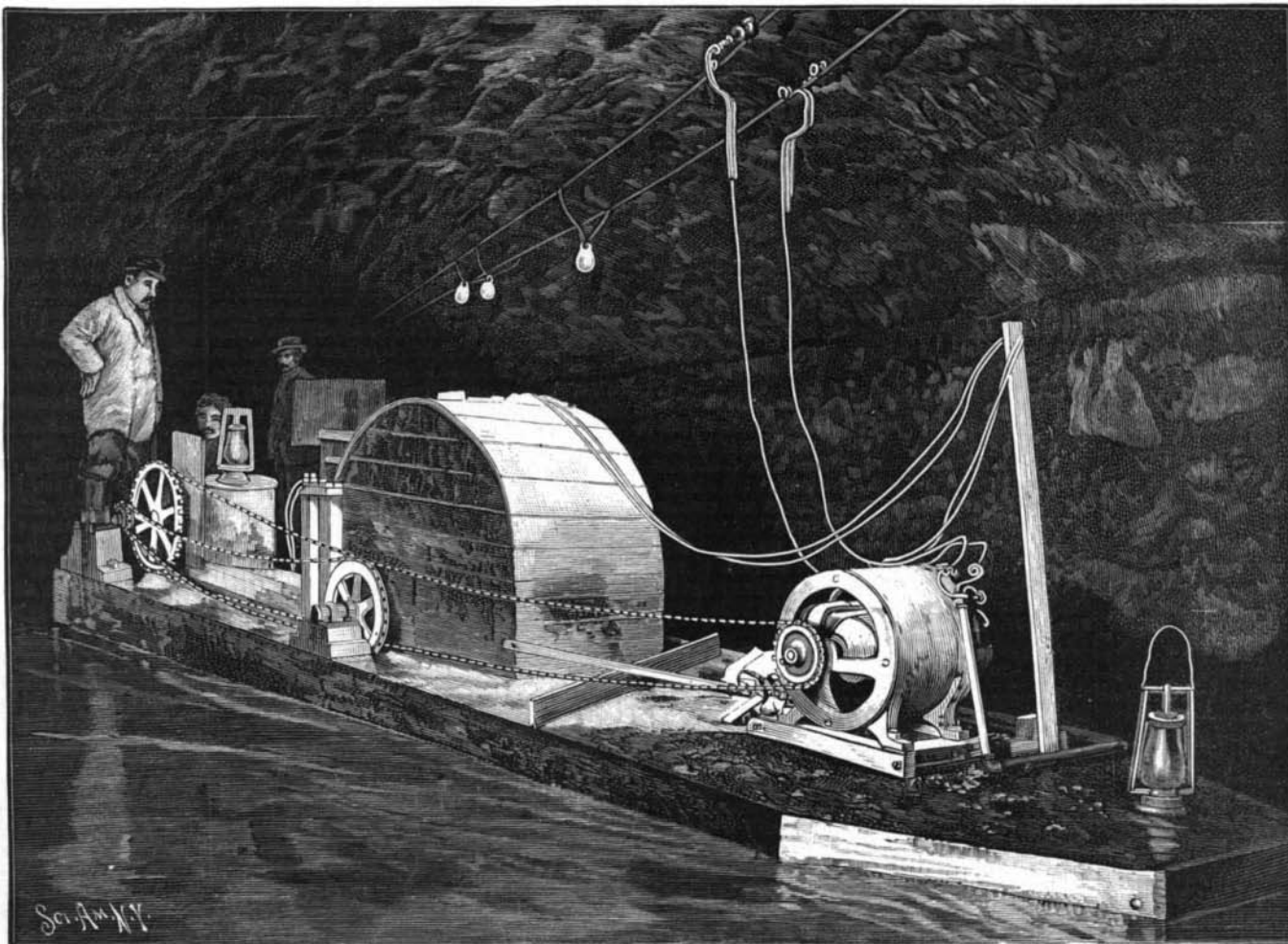
Whole pages of this modern journalism are filled with accounts of discoveries that are going to be made, for writers of this class are shrewd in taking advantage of the fact that human interest and human memory are now practically restricted to about twenty-four hours in time. The publication of a broadside describing an alleged improvement of the telescope or microscope, in which there is absolutely nothing new that is true or true that is new, adorned with a series of cuts largely imaginary and many of which have no relation to the subject matter, has served the purpose intended when its author has received his pay from the "syndicate" and when the syndicate has scored a triumph in what in these days is called "enterprise."

Even the most conservative among men of science are made to appear as willing purveyors of sensationalism by what ought to be looked upon as an unwarranted and illegitimate use of the results of carefully conducted investigations, often before such results have received final construction and approval at their own hands.

If all impressions made by this false popularization of science were to disappear in twenty-four hours, the evil would be greatly lessened; but, unfortunately, there are many very intelligent and thoughtful people, who ought to constitute the best support of scientific work, upon whom they are more lasting. To such the line separating the genuine accomplishments of honest scholarship from the output of sensationalism, which ought to be clear and sharp, is becoming very nebulous, and there is imminent danger of a revolt against the whole thing.

The extent to which credulity has been carried was beautifully illustrated not long ago when a widely known scientific man amused himself and many friends by caricaturing, in the columns of one of our standard scientific journals, some of the phases of modern psychophysics. So perfectly did the burlesque reflect the form and substance of some recent contributions to that science that it was immediately accepted as serious by the large majority of readers.—Prof. T. C. Mendenhall, in Science.

THE work on the middle arch of the Bonn Rhine bridge, which is at present the largest in Germany, being 184 meters wide, is now completed. The result of lowering the enormous iron burden of 1,700,000 kilograms upon the bridge piers was looked



ELECTRIC TOWBOAT IN MAIN SEWER, WORCESTER MASS.

forward to with great expectation. The same has turned out surprisingly favorable, for the two piers only show a lateral displacement of 3 millimeters, which furnishes the best testimonial for their construction. The arch has settled 35 millimeters in the upper edge.

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Forms of Lightning.

In his meteorological essays Arago collects and classifies the descriptions of the different forms that lightning assumes. The first class consists of narrow, thin, sharply defined, luminous lines which may have crimson, violet or bluish colors. These lines may be classified as straight or slightly curved, zigzag or broken lines, greatly curved and even re-entrant, and, finally, forward and return, very nearly resembling the capital letter V. We have also single flashes that bifurcate into a collection of smaller flashes that may number anywhere from two to one hundred, the double and triple forks being least frequent. To these varieties the editor would add a sinuous form of lightning flash that he has seen on several occasions, both in Chicago and Washington, in which the flash appears to run with comparative slowness, horizontally, along the under surface of a cloud, dying out after it has pursued a path whose apparent angular length is from one to five degrees. No noise whatever usually accompanies this lightning, although the flashes may be in the zenith. When last observed, in May, 1897, it seemed possible that these might be simply long flashes viewed endwise, so that the apparent path, which was sometimes so curved as to form a complete oval or spiral, was simply the projection of what would from another location have appeared to be a long flash between an upper and a lower cloud.

The second class recognized by Arago is that of the diffuse lightning, spreading over immense surfaces, often of an intense reddish tinge, but sometimes blue or violet, and which in America and England are spoken of as "heat lightning," but which are more properly called "sheet lightning." During an ordinary thunderstorm the sheet lightning is far more frequent than the flash lightning.

The third class includes the mysterious "globular or ball lightning," which rolls about on the ground and has thus far defied all attempts at satisfactory explanation.

As a fourth form of electric discharge we must reckon on the continuous emission of light from the surface of certain clouds. As these clouds are low, and as the light dies away after a few minutes only to be renewed again after a short interval, we must consider this light as due to myriads of little flashes between the particles of the clouds without appreciable noise.

Besides the lightning interchanged between the

clouds or the clouds and the earth in ordinary weather. A still more interesting fifth class should be made of those that play between the earth and the cloud of ashes and vapor formed above a volcano in active eruption.

There does not seem to be any evidence that in these five classes there is any special new production of electricity. We have only to consider the earth as the electrified body, permanently electrified, and always, by induction, inducing electric manifestations in every substance that is near to it. The auroral light ought to be included as one form of the lightning discharge, since it is certainly a form of electric discharge modified by the rarity of the upper atmosphere from the flash to the stratified sheet lightning. The electric discharge is modified, not merely by the rarefaction of the dry atmosphere of oxygen and nitrogen, but still more so by the rarefaction of the other gases in the atmosphere, such as the hydrocarbons and the carbonic acid gas, and probably also by that of the aqueous vapor, so that air which is very dry or very cold, and therefore contains but little aqueous vapor, may have much to do with the formation of auroras. According to the recent researches of Prof. Trowbridge, the character of the electric current as to intensity and quantity is also a prime factor in determining the character of the luminosity. He has been able to reproduce a great variety of forms of lightning, such as have been photographed from time to time, by proper alterations in his apparatus.—Prof. Cleveland Abbe, in Monthly Weather Review.

Cavalry in Future Wars.

It has been said that the days of dashing cavalrymen will soon be over, and that the art of riding will become as purely a pastime as the art of sailing is destined to become by reason of the introduction of steam, says The Literary Digest. This opinion is combated very vigorously by Major Kunz in his *Kriegs-Geschichtliche Beiträge*. He believes that the uses of cavalry have been changed, but that its existence is not yet endangered. On the other hand, he points out that mere mounted men, as against highly trained riders under the very best leaders, are absolutely useless to-day. Commenting upon the many brilliant though unfortunate cavalry attacks executed by the French in 1870, he says:

"1. A frontal attack of cavalry against victorious in-

fantry can only be justified when the aim is to save time for the purpose of saving the beaten army. The success of such an attack is practically impossible.

"2. Momentary success of an attack against the flank of victorious infantry is possible. But even such an attack must end in the destruction of the force which undertakes it.

"3. If the enemy's infantry is beaten, cavalry may be used to advantage. But it must be faultless cavalry, led by faultless, courageous riders, men who are also perfect in their knowledge of the history and psychology of war. In such a case no thought must be given to a few hundred horses foundering on the field. The enemy's infantry must not be given time to assemble. The cavalry must endeavor to head off the fugitives, for the most disheartened of them will lead the stampede. In the rear of a flying army are always the bravest. It matters little whether the enemy loses much in killed and wounded. The question is not how to kill men, but how to discourage them, to rob them of their leaders, to destroy their organization.

"An infantry which has suffered heavy losses, but has advanced victoriously, and has still sufficient ammunition, may laugh at a cavalry attack. An infantry that has been beaten, and whose officers are killed, and which has lost courage in consequence, is a ready prey for enterprising cavalry. It will be said that, in such a case, the cavalry of the beaten army must sacrifice itself for the infantry. Quite true. The task of the attacking cavalry will then be to overthrow the horsemen of the vanquished army. If this succeeds, the stampeded horsemen will only assist in increasing the confusion of the flying infantry.

"At any rate, a few hundred men and horses dying of sheer exhaustion in the pursuit of a beaten enemy will save the trouble of another bloody battle. To train the cavalry for such work is the purpose of extensive maneuvers."

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RECENTLY PATENTED INVENTIONS.**Engineering.**

GAS ENGINE MUFFLER.—Charles S. Bird, Jackson, Mich. This device comprises a casing in which is suspended a vessel into which projects the exhaust pipe from the engine, a conical spreader being supported immediately below the exhaust outlet, and there being ample room for the gases to expand in the vessel, while a U-shaped pipe is provided for the escape of the gases to the outer air.

SPEED-CHANGING DEVICE AND INDICATOR.—Philip J. Runser, Redfield, S. D. This is a device for use on traction, and other engines, to indicate the speed while the engine is running and to permit the engineer to readily change the speed at any time as desired. The device is more especially designed for use on engines employed for thrashing and similar purposes, and connected to the governor stem is one end of a spring whose other end is connected to a double gear wheel for adjusting the tension, the gear wheel being normally stationary, an operating device engaging one of its series of teeth while an indicator is operated by the second set of teeth. The speed of the engine is changed by increasing or diminishing the tension of the spring.

WATER WHEEL.—David Morgan, Axial, Col. To facilitate raising and lowering a water wheel, and holding it immersed as desired, is the object of this invention, according to which the wheel is carried at one end of a pivoted frame at whose opposite end is a rack and pivoted levers, one lever having a dog and the other a pawl, both arranged for engagement with the rack, the pawl and lever holding the frame in its adjusted position, and the dog and lever being adapted to raise the wheel and assist in lowering it, and the weight of the frame enabling the levers to be easily operated in raising and lowering the wheel.

BOILER ALARM.—John O'Connor and Collatinus A. Turner, New York City. According to the system provided by this invention, an electric alarm or steam whistle alarm may be employed to indicate high or low water, the device comprising a cylinder with water gauge and float from which extends a stem connecting with a shaft carrying an arm to which is attached a yielding contact plate, in connection with an electric circuit, while there is also a spring yielding connection between the arm and a water controlling valve, which is operated by an upward or downward movement of the float.

Electrical.

CALL BOX SYSTEM.—William T. Budds, Charleston, S. C. This system comprises a main wire with which the call boxes have a shunt connection while also having a ground connection, a battery with one pole of which one end of the main wire connects and a wire leading from the other pole of the battery and connected by a switch with a ground wire, a switch also connecting the last wire with the main wire. The first switch also operates to connect the ground wire with an intermediate element of the battery, and there is a sounding device at each extremity of the main wire. The improvement contemplates a single wire open main circuit having a single wire connection with each call box, the circuit being completed through the ground.

Bicycles, Etc.

VARIABLE GEARING.—Samuel J. Evans and Harry H. Muggins, Roanoke, Va. To enable the rider to readily vary the speed of his machine while the latter is in motion is the primary object of this invention, according to which there are a number of concentric gears on the pedal shaft, while a longitudinally grooved shaft at right angles has its rear end geared with the drive wheel, there being a number of loose pinions on the forward end of this shaft to mesh with the gear of the pedal shaft. Separators are arranged between the pinions, the pinions and separators having keyways, while a key sliding in the groove of the shaft is adapted to be moved into engagement with the ways of the pinions or separators.

TANDEM.—Henry M. Hunt, Indianapolis, Ind. This invention provides a construction whereby two bicycles may be easily connected to form a tandem or disconnected and employed as independent bicycles. There is a yielding connection for a leader and trailer, comprising crossheads, one adapted for pivotal connection with the leader and the other with the trailer, while plates having telescopic or tubular portions are mounted to move between the crossheads, and rods extend from the crossheads to connections with the plates. Both the leader and trailer may have one or more seats, or one seat may be omitted and provision made for carrying bundles.

BICYCLE STAND.—William E. Leavitt, New York City. According to this invention, a bicycle stand of strong and inexpensive construction is formed of a block of wood, on a suitable base, a forward inclined groove receiving the front brace, while a transverse groove receives the crank hanger and another groove receives the rear fork. The block is made high enough to hold the wheel free from the ground, permitting the wheels to be revolved and all parts readily reached for cleaning and repairing, and it may also be made sufficiently strong to support the rider while being fitted to the saddle.

Mechanical.

BLANK FOR MANUFACTURING HOLLOW BODIES.—Carl Meyer, Dortmund, Germany. In making seamless hollow bodies from plates or sheets, this invention is designed to facilitate doing the work without materially altering the original distance of the particles of material in a radial direction or in a direction outward from the central portion of the blank. With this view the portion of the blank designed to come directly under the mandrel is made with a marginal portion which for a predetermined distance increases in thickness in such proportion that the area of concentric cross sections at any distance apart from the center of the plate shall be constant, the thickness of the blank at different points being such as would be produced by stretching the finished tubular article into a substantially plain article.

ECCENTRIC.—Casper E. Anderson, Castle Dale, Utah. This invention is for an eccentric which may be reversed by shifting, and is adapted for engines and similar machinery employing slide valves. A sleeve splined on a shaft is inclosed by and has screw-

threaded connection with a second sleeve, a boss keyed to the shaft serving to guide the second sleeve as it turns, while an eccentric pivoted to the plate has connection with the second sleeve, the eccentric having an elongated opening to receive the boss of the plate to permit the adjustment of the eccentric.

CASING CUTTER FOR WELL TUBES.—Silas W. Munn, Mannington, West Va. When the iron tubes or casings of artesian or driven wells are to be cut for removing a section, and it is desirable to make the cut near a joint or coupling, this invention provides a device to automatically indicate the location of the joint and at the same time arrest the descent of the cutter at the right point for dividing the tube or casing. Attached to an upper or lower extension of the rotatable tube cutter is a beveled catch and a spring which projects the device laterally for engagement with the joint of the tube or casing, the device holding the cutting apparatus in proper working position.

Agricultural.

CULTIVATOR.—Frederick H. and Thomas C. Bornman, Summit, Miss. In cultivators or side harrows, this invention provides a means whereby the angle, pitch and spaces or distances of all the blades can be simultaneously adjusted, to secure complete arrangement and exactness in relative position, it being possible to retain the equalizing cross bars to which the spanks of the blades are attached transversely to the beam or at any desired angle. The invention also provides for the use of any form of blade, whether it be a turning plow or a half shovel, either being readily secured to the spanks or stocks and given any desired inclination, the attachment being effected by a shoe and a single fastening bolt and being absolutely rigid.

POISON OR FERTILIZER DISTRIBUTER.—Frank L. Richter, Moravia, Texas. For the distribution of poison or a fertilizer to the plants at each side of a furrow through which the machine may be drawn, this invention provides a machine of simple and inexpensive construction, the frame of which carries a fan near the outlet of the poison or fertilizer receptacle, the valved outlet of which is in communication with an adjusting distributing device consisting of a T-shaped tube, open at the ends of its transverse section, the fan and blower being operated by the revolution of the axle carrying the supporting wheels.

Miscellaneous.

CLOCK.—Sigismund B. Wortmann, New York City. This invention relates to clock-driving mechanism to run with but little friction and take up only a small space, whereby a clock may be run for several years and keep accurate time. The mechanism may be connected to an ordinary one-day clock, enabling the clock to run for a year or more with one winding, and comprises substantially a spring motor, such as covered by several former patents granted to the same inventor, but modified by the addition of certain parts and the substitution of other parts.

ACETYLENE GAS GENERATOR.—James L. Hardwick and Sidney O. Manville, Cedar Rapids, Ia.

This generator comprises a rising and falling holder in which the receiver is supported to carry the carbide into and out of contact with the water, a gasometer to hold the gas being connected with the holder by a pipe, and there being an intermediate mechanism whereby the movement of the dome of the gasometer will operate to control the up and down movement of the holder, where, by only the required amount of gas, as taken off for consumption, will be generated.

EARTH AUGER.—Joseph Carter and William Richmond, Blyth, Canada. A tool for conveniently boring post holes, devised by these inventors, comprises a telescopically adjustable handle with spider-shaped foot piece carrying blades curving inwardly, and attached to a vertically adjustable ring, to regulate the stiffness of the lower ends of the blades, the blades forming a skeleton basket in which the earth is received as the auger is rotated and forced down, and the loose earth being thus removed as the operation progresses.

WHIP SOCKET AND REIN HOLDER.—Marshall T. Howland, Pittsford, Vt. This is a combination device for attachment to the dashboard of vehicles and has two pivoted members arranged to hold the whip and a supplemental member to hold the reins. Two clips are rigidly secured to the whip socket, along which extends a rib, and a post stands rigidly on the upper clip, from which projects a stop, while a spring embracing the post serves to throw a shoe toward the rib.

SAFETY DEVICE FOR ENVELOPES.—Aaron H. Danner, Manheim, Pa. To prevent the fraudulent opening of envelopes by steaming or otherwise, this invention provides for the cementing of a piece of material to the inner face of the envelope adjacent to the address, such material being covered by the sealing and not being liable to be loosened without blurring the address. Another form of the improvement provides for an inner and outer envelope, the sealed side of the inner envelope being cemented to the back of the address portion of the outer envelope.

COFFEE ROASTING.—John W. Pinkerton, Zanesville, O. This invention covers a method and apparatus for roasting coffee, the apparatus comprising a roasting furnace in which is a coffee cylinder having a hood or cover with an opening, a burner being movable into and out of the opening, whereby a gas flame may be introduced at intervals as the roasting proceeds, the method being to subject the roasting coffee to the intermittent action of direct flame and thus insure a more immediate evaporation of its moisture.

SPRINKLING NOZZLE.—Arthur W. Joy, Bangor, Me. This nozzle is designed for sprinkling roadways, lawns, etc., and to be connected with underground pipes, the top of its body being rounded to lie flat on the curbing or project slightly therefrom, so as not to obstruct travel. It has a central water supply chamber communicating by ports with outer flaring sockets in which are conical hollow heads, each provided with a series of outlets, a seat being formed at the smaller end of each head for a ball valve, while the outlets form spraying passages or ways around the ball.

WHIST TABLE.—William P. Morrissy, Brooklyn, N. Y. This inventor has devised a table especially adapted for duplicate whist, in which the hands