

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

SIGNALING APPARATUS.—George B. Williams, Portland, Oregon. This invention provides a conductor's signaling valve in which the exhaust from the signaling pipe is automatically regulated by means of a trigger device, with other novel features, forming a simple and durable apparatus designed to transmit accurately and promptly signals from the conductor to the engineer of a train by means of compressed air, the apparatus being also adapted for employment in signaling work with stationary plant.

RAILWAY RAIL FASTENING.—Thomas J. Bush, Lexington, Ky. By this invention, diagonal intersecting holes are bored in the tie to receive interlocking bolts which pass through sloping clamp plates and through slotted plates on top of the tie, thus affording a uniform and level foundation for the rail, which is prevented from settling into the tie and shifting out of gauge.

DIE FOR MAKING BOLTS.—The same inventor has also obtained a patent for a machine for making interlocking bolts, such as required in this rail fastening, the machine comprising a die and a punch or mandrel to face off and recess the end of the bolt to form a locking shoulder, the invention being an improvement on a former patented invention of the same patentee.

ELEVATED RAILROAD.—John N. Valley, Jersey City, N. J. Two patents have been granted this inventor for structures adapted for passenger or freight carrying purposes, and also for use in timber lands for getting out logs, or in mines, etc., the improvements relating mainly to the mode of suspending and bracing the track rail from a stringer sustained by struts, and in a method of laying or fastening the track rail sections on the sleeper to maintain its straightness both ways, for promoting greater ease of travel of a carriage or trolley and giving increased durability to the entire structure.

Electrical.

POTENTIAL REGULATOR.—Alvirus L. Ellis, Kansas City, Mo. A pair of electric motors is connected with the potential controlling devices and with the main circuit, and a circuit controlling magnet and armature are arranged to send the current to one or the other of the motors, thus operating the potential controlling device in accordance with the requirements of the circuit, the arrangement being applicable in a circuit carrying either a direct or an alternating current.

Agricultural.

POTATO PLANTER.—Ferdinand Storck, Buena Vista, Col. In this frame a vertically adjustable standard carries a plow with which is connected a seed tube, while there are adjustable covering plows in the rear of the main plow, with other novel features, by means of which potatoes may be planted in a straight line and with the hills at equal distances apart.

PLOW AND FERTILIZER DISTRIBUTER.—Silamon McLean, Mineral Springs, S. C. In this machine the fertilizer hopper is independent of the plow beam, and may be readily removed therefrom, while the distributing section in use normally sustains all the weight of the fertilizer, and the plows may be raised and lowered at the will of the operator, the machine being adapted to distribute either damp or dry fertilizer, placing the material at the bottom of the furrow and thoroughly incorporating it with the soil.

COTTON STALK PULLER.—Lewis L. Womack, Zephyr, Texas. This machine has a pulling wheel journaled near the ground on the lower end of a short vertical axle, and operated by gearing from the main horizontal axle, the stalks being received between teeth and the rim of the wheel, and as the machine advances, the stalks are pulled up and discharged at the rear of the machine.

CHURN.—James McBride, Bavington, Pa. This invention covers an improvement in what are known as "barrel churns," and provides a churn that may be easily operated, in which the cream may be readily placed and removed, and which is designed to quickly and thoroughly do its work, the body of the churn being given an end over end motion if desired, or rotated in a horizontal position.

CATTLE STANCHION.—The same inventor has obtained a patent for a stanchion to which an animal may be quickly and readily secured, while at the same time great freedom of movement is allowed, means being provided in connection therewith for preventing the animal from fouling the floor of the stall.

HAY PRESS.—John B. Foresman, Foresman, Ind. In connection with the baling chamber is a revolving feeding chamber, feeding rollers lying near the edges of feeding wings and forcing material into the baling chamber, the baling operation being continuous, and the bales of hay and straw being compacted and banded and automatically ejected from the machine.

Miscellaneous.

BRUSH SCRAPER FOR PAINT PAILS.—David F. Brown, Omaha, Neb. This is an attachment adapted to clamp the edges of the bucket, and made of spring wire, having an inner scraper portion and an exterior clamping portion with spring bows which engage the rim of the pail or bucket.

SAMPLE CASE.—Henry Noee, Chicago, Ill. This is a case for the display of carpet samples, providing for the arrangement of a large number of various patterns within a small compass, the samples being readily changed, and arranged for display by turning them over as the leaves of a book, without liability of scattering or soiling them.

BURIAL APPARATUS.—Nicholas Brickell, Poplar Grove, Ark. A knock-down frame is adapted to be placed over a grave, with parallel tracks, and a carriage forming a bier running on the tracks to

receive the coffin, the carriage having pivoted handles, to facilitate lowering a coffin or casket to the bottom of a vault or a grave.

ATOMIZER.—Edward T. Kassel, New York City. This is a device for spraying perfumery and antiseptic or other liquids, for toilet, medicinal, or surgical uses, the device allowing strictly localized applications of antiseptic or other fluids by one hand of a surgeon while leaving his other hand free to perform an operation.

FOUNTAIN INKSTAND.—James V. Bergen, Austin, Texas. This invention provides an attachment for inkstands designed to be simple and durable in construction, and by means of which the ink is confined in air and dust proof reservoir which can be easily cleaned when desired, the operator only having to remove a cover to get at all the parts.

ADJUSTABLE BOOK REST.—Charles W. Beccannon, New York City. This support has a foot piece attached thereto by hinges, the lower edge of the support having a ledge to serve as a stop for the book, and the support being provided with triangular bails of different sizes hinged to its back or lower surface, whereby it may be set at any desired angle, the device being also adapted for use as a writing desk or table.

ADDING MACHINE.—Gideon B. Massey, Mamaroneck, N. Y. (deceased), Sarah R. Massey and Stanley A. Bryant, administrators. A series of number wheels are operated simultaneously by slides having numbers corresponding to those on the wheel, there being also a "carrying" mechanism, and a novel printing and paper feeding mechanism, for obtaining an accurate total of a series of large numbers, so that the total and the sum added are recorded every time an addition is made.

CASH REGISTER.—This is another patented invention of the same inventor for the construction of a check-printing machine which will print, number, and cut off checks in succession, and at the same time produce a continuous record of the numbers of the checks, an indicator being provided for showing the position of the check-numbering wheels.

AUTOMATIC WEIGHER AND PACKER.—John A. Ostenberg, Des Moines, Iowa. This is a machine for weighing starch, spices, and similar material, and discharging it into boxes, bags, or other packages, a standard carrying a sleeve with a series of weighing scales, while a circular hopper discharges through shaker spouts into the boxes of the scales, and a mechanism is provided for shutting off the supply of material when the proper amount has been fed.

TRANSPOSING KEY BOARD.—Anders Holmstrom, New York City. Combined with a movable transposing key board is a latch device, allowing the key board to be latched when adjusted to any desired position, preventing accidental movement and holding the keys in proper relation to the action stems for playing the instrument, and allowing change of pitch of tone for obtaining different musical effects by fingering the same keys.

STREET LETTER BOX.—Ira G. Lane, New York City. This is a box designed to be entirely of iron and having a neatly finished connection with the ordinary lamp post, with a top hood forming a newspaper or package compartment, and a hinged drop lid provided with a swinging tray, while the discharge opening is partly in the front and partly in the bottom, the front and bottom doors being coupled together for simultaneous operation.

HOUSE DOOR LETTER BOX.—This is another patent by the same inventor for a box to be placed on the inside of a door or partition wall, and provided with an interior bar to prevent abstraction of mail from or at the drop lid or inlet opening, and also to facilitate the passage of mail into the box, while an alarm device is connected with the box to give notice whenever the drop lid is opened.

MEAT HOLDER.—Robert W. Randle, Portland, Ind. This is a device adapted to hold a ham or joint of meat while being carved, having a series of upright fixed clamping fingers, and a pivoted and adjustable clamping arm, with a lever for closing the latter toward the fingers, and a catch to hold it when closed, there being a removable cover inclosing the whole, and a ventilating screen.

MEASURING VESSEL.—Henry W. Laun, Englewood, Ill. This is a transparent vessel protected by a jacket, whereby liquids may be measured without the use of an additional measuring cup, there being a graduated scale on the side of the liquid receptacle, and a faucet partly in its bottom and partly in its side.

CLOTHES DRIER.—Mary L. W. Martinot, New York City. This device consists of a square drying chamber, having a heat fire in the bottom and outlets in the top, with parallel slideways on its inner walls, and clothes-holding trays formed of slats, and other novel features, being especially adapted for use with oil or gas stoves, etc., providing means whereby clothes may be quickly dried indoors without danger from too much heat.

WATER CONDUCTOR FOR TURBINES.—John Graham, Minneapolis, Minn. This conductor has a siphon pipe inserted in the water reservoir, a novel description of readily operated valve at the mouth of the pipe beneath the water level, a vent valve at the top of the siphon, a pipe from the trunk pipe below the head on the long leg of the siphon connecting with a suitable pump, and a gate valve at the lower end of the trunk, where water is supplied to the turbine.

FORCE PUMP.—Frederick F. Danaher, Brooklyn, N. Y. This is an improvement in that class of devices known as plumbers' force pumps, designed for convenient and expeditious application to a sink, or for other uses of a similar nature, the invention covering a novel construction and combination of parts.

TREATING POTASSIC SALTS.—Bernhard Peitzsch, Stassfurt, Germany. This invention consists of a process of treating potassic raw salts, as found in a mineral state at Stassfurt, to manufacture therefrom potash, soda, hydrochloric acid, magnesia,

gypsum, and sulphur or sulphuric acid, the process allowing of the direct manufacture, without any waste products.

DISINFECTING PAVING COMPOSITION.—John Fottrell, New York City. This invention provides for the use of carbolic acid in connection with a body of Portland or any suitable cement, the acid being thoroughly mixed with the cement in proportions varying according to the locality where such pavement is to be laid, after which the cement is applied, mixed with water, in the usual way.

BICYCLE CRANK.—William Blakely, Bournemouth West, England. The crank arm is formed of a shell of stamped steel plates clamped upon a wood core, the axle journals being fluted and the flutes filled with agate or other hard material, while the metal shell has an eye notched to correspond with the flutes of the axle, the construction forming a light and very stiff shaft or axle, not likely to spring or bend under the weight of a heavy rider.

CHECK HOOK.—Karl G. Bareis, Madison, Wis. This invention consists of a hollow post adapted to be secured to the back pad or saddle of the harness, with an arm to be opened or closed on the post to insert and retain the check rein in place, making a simple and efficient device, which is ornamental in appearance.

VEHICLE POLE ATTACHMENT.—Henry W. Roberts, Duncan, Mich. A spring-pressed bolt is fitted to slide in a post on the holdback, the base plate of which the bolt is adapted to engage, forming a safety attachment designed to conveniently and securely fasten the ring of the neck yoke to the holdback of the pole or release it when desired.

DUMPING CART.—Timothy Flanigan, Chicago, Ill. This is a cart especially designed to carry garbage and half-liquid substances, as well as for ordinary purposes, the closed dumping body on the frame in the rear of the seat having a door, with a locking mechanism, and there being a connection leading from the lock to the driver's seat.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION. FEBRUARY NUMBER.—(No. 64.)

TABLE OF CONTENTS.

- 1. Handsome plate in colors of an elegant residence on Chestnut Hill, Mt. Vernon, New York, erected at a cost of \$12,000 complete. Two perspective views, floor plans, etc.
2. Colored plate representing an attractive residence at Auburn Park, Chicago. Cost \$7,000. Floor plans, perspective elevation, etc.
3. Plans and perspective view of a carriage house erected at South Orange, N. J., at a cost of \$2,700 complete. H. H. Holly, Esq., architect, New York.
4. A residence at South Orange, N. J. Cost \$11,000 complete. Perspective elevation, floor plans, etc. Architect, H. H. Holly, New York.
5. Handsome residence of Gothic design at Germantown, Pa., erected for Mr. B. P. Wilson. Perspective elevation and two floor plans.
6. Cottage in Sophia Avenue, Chicago, estimated cost \$2,800. Floor plans and perspective elevation.
7. Perspective elevation and floor plans of a recently erected cottage at Stratford, Conn. Cost \$2,700 complete.
8. A colonial residence erected at South Orange, N. J., from plans by Rositter & Wright, architects, New York. Cost \$17,000 complete. Perspective elevation and two floor plans.
9. Cottage at Austin, Chicago. Estimated cost \$3,700. Floor plans, perspective view, etc.
10. Floor plans and perspective view of an elegant cottage at Austin, Chicago. Cost about \$5,000.
11. A corner of a boudoir, designed by J. Armstrong Stenhouse. Half page illustration from a colored drawing, which appeared in the Royal Academy exhibition last year.
12. A picturesque cottage of moderate cost at Austin, Chicago. Two floor plans and perspective elevation. Estimated cost \$900.
13. Miscellaneous contents: Jarrah wood.—Biographical sketch of Henry Schliemann, the archaeologist.—Bronze castings.—The SCIENTIFIC AMERICAN a help to builders.—American stone fields.—How can iron pulleys be papered?—England's favorite hard woods.—Floors.—Plaster.—Developments of construction.—Corrosion of zinc in contact with brick.—Etching upon glass.—Magnesia in cement.—Our last year's volume.—Improved woodworking machinery, illustrated.—A novel calendar, made of tin.—Broughton self-closing basin cock, illustrated.—The Edison recording pressure gauge.—A new gasoline engine, illustrated.—Universal file handle, illustrated.—The Dunning hot water heater.—Improved conduits for electric wires, illustrated.—A thoroughly built parlor door hanger, illustrated.—California fruit.—Labor-saving appliances for the carpenter and builder, illustrated.

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Billings' Patent Adjustable Four and Six Inch Pocket Wrenches. Billings & Spencer Co., Hartford, Conn.

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HINTS TO CORRESPONDENTS.

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(2856) F. P. R. asks: What substance will make gold leaves adhere permanently to paper, and what is the mode of its application? A. Glaire, which is pure albumen, is sometimes used. It is made by shaking up the white of an egg with a few drops of ammonia, and drawing off the clear liquid, which has subsided on standing. This is painted on the lines, and by slight heat, as of a hot iron, the leaf adheres. Gold size is used on thick paper, or thick gum arabic water may be used. The illuminators of to-day cannot get as good results as did the old workers of the middle ages. The old gilding is never equaled now.

(2857) D. B. P. asks: What preparation is suitable to be placed on boxwood, for the purpose of photographing on, preparatory to engraving? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 576, page 9203, for formula and particulars.

(2858) H. G. L. asks: What is the law for the magnetic field? A. The field developed by an electro-magnet varies directly as the current strength and directly as the number of convolutions of wire.

(2859) I. S. B. asks for a formula for making corn remedy, either liquid or plaster.

Table with 2 columns: Substance and Quantity. Salicylic acid30 grains gr. xxx. Cannabis Indica (Indian hemp) 5 grains gr. v. Castor oil 1/2 drachm 3 ss. Collodion 1/4 ounce 3 ss.

Mix and apply morning and evening for four days. Then soak the feet in warm water. If this be done faithfully, the corns are removed without any difficulty. 2. How is sticking plaster made, such as surgeons use for drawing together the edges of wounds? A. Adhesive plaster:

Table with 2 columns: Substance and Quantity. Litharge 5 ounces 3 v. Olive oil 12 ounces 3 xii. Water 8 ounces 3 viii.

Put the water and litharge into a copper pan. Mix together with a spatula, add the oil, and boil, stirring constantly. This process takes from 4 to 5 hours, but it can be hastened to 20 or 30 minutes by adding an ounce of colorless vinegar. To make resin or strapping plaster, used in retaining the lips of recent cuts and wounds in contact: Mix by a moderate heat 1 ounce of resin to 5 ounces of litharge plaster (as given above) and spread upon muslin. 3. How is court plaster made? A. Bruise a sufficient quantity of isinglass, let it soak in a little warm water for 24 hours, expose it to heat over the fire

till the greater part of the water is dissipated and supply its place by proof spirits of wine, which will combine with the isinglass. Strain the whole through a piece of open linen, taking care that the consistency of the mixture shall be such that when cool it will form a trembling jelly. Extend a piece of black or flesh-colored silk on a wooden frame, and fix it in that position by means of tacks or twine. Apply the isinglass—after it has been rendered liquid by a gentle heat—to the silk with a brush of fine hair. As soon as this first coating is dried, which will not be long, apply a second and even a third. When the whole is dry, cover it with two or three coatings of balsam of Peru. In Remington's Pharmacy will be found a cut of a machine for spreading plaster.

(2860) J. E. S. asks: 1. What is the derangement that causes itching in chilblains? A. The derangement is usually due to an inactive skin and poor circulation, as a consequence of warming hands and feet before the fire when they are cold and damp. 2. Why do they reoccur in the same spot? A. They occur in the extremities, where the circulation is poorest, and are red swollen patches which are the seat of severe itching and tingling. 3. What is the best remedy for the same? A. Increase the activity of the skin and general circulation by a generous diet, active exercise and friction. Rub on soap liniment, or equal parts of tincture of camphor compound and tincture belladonna applied night and morning. See next query.

(2861) R. P. B. says: About two years ago I saw in your paper a cure for chilblains which I tried with success. I have not had a return of them till now. I have a slight touch of them, and have forgotten the cure. A. a. Equal parts of tincture camphor compound and tincture belladonna, to be rubbed in night and morning. b. A saturated solution of salt in warm water is also good. c. Local faradization of the parts is also good. 2. After a cold the glands of my neck swell quite badly. Can you tell me the cause and what will stop it? A. The causes of gland enlargement are manifold. Hereditary predisposition and impairment of health are predisposing causes, but it is local irritation or inflammatory disease in organs or tissues with which these glands have a connection that the source of enlargement may frequently be traced. Treatment is to bring up the general condition of the system by use of iodide of iron in the form of pills or sirup (internally) and an external application of tincture of iodine over the swollen parts. If much pain be present, a useful liniment is one of equal parts of chloroform, belladonna liniment, laudanum, and spirits of camphor. See preceding query.

(2862) C. G. C. says: Would you kindly inform me of the medicinal properties, uses, doses, etc., of salol and exalgine? A. Salol (C₆H₅(OH)CO₂C₆H₅) is a derivative of salicylic acid. One atom of hydrogen is replaced by the phenyl group. In the small intestine salol is broken up by the pancreatic juice, and yields 36 per cent phenol and 64 per cent salicylic acid. Salol is largely used as a substitute for salicylic acid in rheumatism and neuralgic affections, and as an internal antiseptic in the treatment of typhoid fever, etc. Dose—1 to 2 grms., or 15 to 30 grains, smaller doses being preferable. Exalgine is a derivative of the aromatic series discovered by Brignotet. It is prepared by the action of methyl iodide on sodium acetanilide. In its physiological action it resembles antipyrine. It is used more for the relief of neuralgic pains than it is to reduce fever. It is also said to decrease the amount of sugar in diabetes. Dose for an adult 10 grains.

(2863) W. J. R. asks: 1. What is chloride of calcium? A. A chemical salt, a compound of chlorine and calcium. 2. Is it liquid or solid? A. Solid, easily soluble. 3. Where can it be obtained in large quantities, and at what price? A. At any wholesale druggist's; 10 cents a pound upward, according to quality. 4. Is it ever used to absorb moisture, and with what success? A. Yes; with good success. 5. What is the best substance known for absorbing moisture? A. Phosphoric anhydride, the pentoxide of phosphorus.

(2864) A. W. L. says: Will you please tell me what horse leek is? In reply to query No. 12, June 14, 1887, SCIENTIFIC AMERICAN, the name is used. I have searched almost everywhere for the information without obtaining satisfactory result. A. Horse weed we think is the term you mean. It is called also Ambrosia trifida, horsecaws, bitterweed. It is an annual, flowers in August and September. It is found in low grounds from Canada to Georgia, and west to Louisiana and Arkansas. An infusion made from this weed has been recommended locally in mercurial salivation. *Sempervivum testorum*, or house leek, is indigenous to the Alps. It now grows throughout Europe on old walls and houses and is cultivated in North America. The leaves have an acidulous taste and contain malates. House leek is refrigerant, antispasmodic, astringent. Its expressed juice was once used in dysentery and hysterical disorders. Externally it is used as a dressing for ulcers and chronic skin diseases and hemorrhoids. It is also used to soften corns and warts.

(2865) Oakland asks how to solidify pure charcoal (spherical or spheroid) for filtering purposes. A. Mix charcoal dust with molasses, press into shape, and bake at a red heat in a closed vessel. The block should be embedded in charcoal dust. There must be some outlet provided for gases; the closing of the vessel must not be hermetical. Sand or ground pumice may be mixed into the composition to increase its porosity.

(2866) R. N. asks: What acid or acids will dissolve pure gold into a soft, spongy mass? A. Gold is dissolved by a mixture of hydrochloric acid with an oxidizing agent such as nitric acid. On evaporation it may be thickened, but with danger of decomposing the soluble chloride of gold.

(2867) A. J. W. asks: Will you please inform me of a cure for red pimples in the face? A. Pay strict attention to diet and habits of life, avoid rich, highly seasoned, indigestible foods, take ordinary tonics, and especially arsenic. The most efficient local application is a saturated solution of boric acid in alcohol, washing the face but once a day in warm water. Dry with a soft towel and apply the solution. This (the boric acid solution) may be applied three or four times daily. Rochelle salts in water are also a good external application.

(2868) N. O. P. asks: Can you tell me of any medicine that will reduce flesh without injury to health? I have tried all kinds of exercise, but I keep gaining all the time, till I am commencing to feel clumsy. A. Systematic exercise, strict attention to diet, avoiding starches, sweets, malt liquors, wines, etc. Drink freely of alkaline mineral waters, and take (if an adult) 1/4 grain of potass. permanganate twice daily.

(2869) A. G. asks: Can you tell me how to congeal gasoline so it will be thick like lard, and it looks white, just about like lard? A. Some petroleum can be thickened by emulsion with aqueous extract of slippery elm bark or with a strong solution of glue. We doubt if you will succeed with true gasoline.

NEW BOOKS AND PUBLICATIONS. FINANCIAL REVIEW. Annual. 1891. William B. Dana & Co. Office Commercial and Financial Chronicle. New York, N. Y. Pp. 156.

This work is an excellently arranged and systematized review of the railroad business of the country for the past year. It gives the finances of each road in a detailed statement, with a tabular statement in brief at the top of the pages of the statistical part. It is preceded by treatises on the past year, business and speculation, and general financial and commercial topics. Numerous railroad maps are given to show the routes of the different railroads described. The statements of highest and lowest prices of railroad bonds in New York (monthly for five years), and of stock and bond quotations in this city and other markets, Boston, Philadelphia, and Baltimore, is a particularly attractive feature.

THE CRYSTAL BUTTON, OR ADVENTURES OF PAUL PROGNOSIS IN THE FORTY-NINTH CENTURY. By Chauncey Thomas. Edited by George Houghton. Boston and New York: Houghton, Mifflin & Co. 1891. Price \$1.25.

This work is offered as a companion piece to Edward Bellamy's "Looking Backward." It very ingeniously depicts the supposed advances in science and art that are to come, and treats of governmental relations to the people, which, like all his class of writers, he depicts as very uncomfortably close. The less governed the best governed is a maxim foreign to all this school from the days of Sir Thomas More to the Bellamy epoch. It is very graphically written, and will be found interesting reading.

PRELIMINARY SURVEY AND ESTIMATES. By Theodore Graham Gribble. London: Longmans, Green & Co. 1891. Pp. xx, 420. Price \$2.25.

The subject of rapid survey of large regions of uncivilized country, the preliminary work of reconnaissance and kindred subjects form the topics of this work. The practical way in which so eminently practical a subject is treated, and the description of the application of special methods to what may be called the rough work of surveying and topography, give its value to the work and indicate its general scope. We believe the work will be acceptable to many civil and military engineers.

A YEAR BOOK OF FACTS ON DRY GOODS.—The Textile Publishing Company, New York City, have issued a year book for 1891, containing statistical tables important to the dry goods trade. It contains a valuable compendium of the new tariff law and abstracts of the banking, interstate commerce, and recent decisions by the Treasury officials and Board of Appraisers.

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INDEX OF INVENTIONS For which Letters Patent of the United States were Granted February 17, 1891.

AND EACH BEARING THAT DATE.

Table listing inventions with patent numbers and dates, including items like adding machine, aerial ventilator, air brake, and various mechanical devices.

Table listing inventions with patent numbers and dates, including items like bracket, brake, brake shoe, and various mechanical and electrical devices.

Table listing inventions with patent numbers and dates, including items like insect powder distributor, iron, ironing board, and various electrical and mechanical devices.