to operate above coil, the size of plates being 5x7 inches? A. We do not know that this point has been determined. 3. Would two carbons and one zinc in a battery give better results than a pair, and what should be the thickness of each? A. Two carbons and one zinc are better than one carbon and one zinc; one-fourth of an inch is a good thickness for each. 4. How is the length of a spark of an induction coil measured? A. The length of a spark of an induction coil is the distance between the points from which the discharge takes place.

(42) J. H. asks if a building roofed with iron is any more liable to be struck by lightning than one built of wood. A. An iron roofed building is no more likely to be struck than one of wood. The iron roofed building is the safer if struck; especially so if the roof is well connected with the earth by rods.

(43) G. J. S. asks if lightning would be carried into a house by a copper wire soldered to a copper lightning rod a few feet above ground, so as to form a ground connection for the telephone described in SUPPLEMENT, No 142? A. If the ground to your lightning rod is insufficient, the lightning would probably follow the wire into the house, provided it could find better ground thatway. 2. Would an acoustic telephone work better with brass than with copper wire? A. A light twisted wire cable is said to be the best conductor for the acoustic telephone.

(44) J. W. B. writes: Suppose an endless iron chain should be revolved through a longitudinal helix, charged with electricity from a galvanic battery, would I meet with as much resistance in revolving the chain either way as I would in extracting a straight bar magnet suspended within the same helix? A. The resistance will be less than that of the magnet, but it would still be considerable.

(45) J. M. K.—We do not recognize the kalamein process. If you refer to carbonizing the surface of iron, we think it compares favorably with galvanizing.

(46) H. E.—Electric light carbons will answer for telephone transmitters. The French is the best. Polish the carbons by rubbing them on the finest French emery paper.

(47) J. R. F. asks how he can find the prices for which some of the principal American patents on dynamo electric machines and arc lamp regulators have been sold. A. We know of no means of getting at the prices of dynamo patents. The sum mentioned in the assignments is generally nominal. The real price is a secret.

(48) J. R. W. asks: 1. Is there a self-closing telegraph key in successful operation? If there is, can you give a description of it? A. We are unable to find any self-closing telegraph keys in actual use. 2. Would a key of this kind be of any value if a success? A. It would depend somewhat on the manner in which it operates. We could not tell without seeing a sketch or description of it.

(49) L. C. B. asks what to line silver and nickel plating tanks with, so they will not leak—something that will last? A. Coat the inside with good asphaltum, applied in the melted state. See article on Electro Metallurgy, SCIENTIFIC AMERICAN SUPPLEMENT No. 310.

(50) W. A. R. asks: Why is it that with a steam fire engine you can create a greater pressure in the air chambers than the pressure of steam which is in the boiler? It is a piston engine, with the steam cylinder on one end of the piston, and a plunger pump on the other. And yet 80 pounds steam pressure will work up 150 pounds water pressure. A. Because the steam piston has a larger diameter than the water piston.

(51) W. M.—The method of removing superfluous hair by electrolysis is described accurately in Duhring's Diseases of the Skin, 3d edition, page 425. Dr. J. Magee Finny, of Dublin, has been very successful in using this method.

(52) C. C. B. asks: What causes the report on firing a gun? In a controversy on the point, a man in this shop claimed that it was caused by the air rushing back into the barrel of the gun, and was not made till the air reached the breech on its return. I maintained that the outrush of gas dealt the outside air a blow, projecting the sound waves in advance of it, and that the air did not rush back into the barrel at all, as the barrel is already full of the gas caused by the combustion of the powder, and a comparatively slow change of place, or endosmose and exosmose, takes place between the gas and the outside air. A. It is the blow of the explosion on the air. Your views are correct.

(53) J. W. asks: 1. Does it make any difference as to the amount of wire you use for the secondary coil of an induction coil to obtain a spark? How much battery power for one three inches long? A. Up to a certain limit the more fine wire you use the better; but when the wire of the secondary coil is too far removed from the influence of the primary and its core, the wire becomes useless. One cell of Grenet battery should be sufficient to operate a coil of the size given. 2. Is it necessary to have a commutator for a dynamo machine? A. We know or no practical dynamos that operate without a commutator.

(54) H. D. writes, asking for a little information in regard to lining up a propeller engine shaft; some of us here differ in regard to the right way of finding this out. A. If you know that the cylinder is in line, draw a line through it and down past the shaft; by traveling the crank pin to the upper and lower center, you can see if is true to the line of the cylinder; then to test it at half stroke, draw a line at right angles to the general fore and aft center line, and travel the pin to it.

(55) J. R. J. writes: I wish to make a soft porous paper one-sixteenth inch thick as fireproof as possible, and also make it as hard as possible without destroying porosity. What chemicals or ingredients can be combined, and what proportions, to accomplish my object? A. Paper can be made fireproof by dipping it in a solution of alum and then drying. Newspapers are rendered fireproof by dipping into a solution of soluble glass of 25° Baume, then neutralizing by diluted hydrochloric acid of 10° B. while hot, and drying in the atmosphere. Fireproof paper is generally made by using fireproof materials, such as asbestos. See also SCIENTIFIC AMERICAN for November 10, 1883, and *Journal of Society of Arts*, vol. xxxi., pages 880—96.

(56) C. W. asks whether it makes any difference if the layers of wire used in the primary coil of the "Little Giant Battery" are not wound tightly, and the wires of each layer are very close together. He says he has wound one, using 1 ounce No. 38 silk covered wire. Is this is a sufficient amount to use? A. We do not recognize the "Little Giant Battery" by name. The wires of your coil should be carefully wound. One ounce of No. 38 wire should be sufficient.

(57) H. B. asks (1) how the porcelain that is put into iron kettles is put on. Is a brush used, and then is it put into a kiln and baked? A. Iron ware is enameled with porcelain by first cleaning the surface free from moulding sand, then heating the articles in an oven to a low red in the dark, or what is called a black heat, to slightly oxidize the surface and free it from grease. Then brush the powdered enamel mixed with water, and dry quickly. Then bake with a red heat. 2. How is the porcelain mixed? Is it a powder, and mixed with water or some other liquid? Please inform me how to make the liquid or composition. Also where I can get the porcelain. A. For the second or finishing coat, brush on the glaze coat and treat as the first. For the first coat make a mixture of 66 parts calcined flint ground to a powder, 34 parts borax. Melt these together and pulverize, then add 12 parts potter's clay. Mix the whole with water to the consistency of paint, and apply as above. For the glaze coat take 15 parts borax, 73 parts powdered glass, 12 parts soda. Mix and melt, then pulverize and apply with water. Bake at a red heat.

(58) F. A. L.—The oil of bergamot is obtained from the fruit rind of *Citrus bergamia*, and is extracted by expression. The oil of Portugal is similarly obtained from the rind of the sweet orange, and the oil of canella is procured from the aqueous distillation of the *Canella alba*. Opium is the juice obtained by cutting the unripe rind of the white poppy, and hardened by exposure to the air.

(59) W. P. W.—The following is the formula for Batchelor's Hair Dye: No. 1. To 1 ounce pyrogallic acid dissolved in 1 ounce alcohol add 1 quart soft water. No. 2. To 1 ounce nitrate of silver, dissolved in 1 ounce of concentrated ammonia, add 4 ounces of soft water. Apply each number alternately with separate brushes. The nitrate of silver is worth $1.25 per ounce, and the pyrogallic acid 50 cents per ounce. The remaining ingredients are inexpensive.

(60) D. G. asks: Can canvas be made fireproof, that is, to a certain extent, so it will not ignite from sparks from a boiler used at a portable saw mill? A. A coating of soluble glass will answer, provided it is not exposed so as to be washed off by rain, etc. SCIENTIFIC AMERICAN SUPPLEMENT, No. 245, gives a number of recipes for the purpose of rendering fabrics fireproof.

(61) J. R. M.—For mahogany staining make a madder containing ½ pound of madder, 2 ounces logwood chips boiled in a gallon of water; brush this over the wood while hot; when dry go over this with a solution of pearl ash, 2 drachms to 1 quart of water; size, and polish. The wood is then carefully washed, dried, and polished in the usual manner. The above or in fact any desired stain can be placed outside the rug. A figured border can be put on by means of a stencil, that is, staining or the reverse such parts as are not protected by the plate.

(62) S. O. asks for a good varnish or polish for pianos or finish on furniture. A. Try the following: Put in a bottle 2 ounces gum sandarac, 1 ounce shellac, ½ ounce gum benganium, 1 ounce Venice turpentine, and a pint spirits of wine. Color red with dragon's blood or yellow with saffron. Stand in a warm place till gum dissolves, then strain for use.

(63) D. W. De S. asks for a receipt for sheeting and preparing wax for flowers. A. Wax that is used for modeling is generally the white variety, which is melted and mixed with lard to make it malleable. In working it the tools and the board or stone are moistened with water to prevent its adhering; it may be colored to any desired tint with dry color. To make it into sheets it may be run into suitable moulds.

(64) D. W. W. asks (1) if a dynamo electric machine is not an equivalent of a galvanic battery as electric generator for medical and surgical puposes. A. The current from the dynamo electro machine is substantially the same as that produced by a battery. 2. Cannot one man furnish the power with a dynamo constructed for the purpose, to bring the usual cauterizing electrodes to a white heat? A. It would require rather more than one man power to bring the cauterizing electrode to a white heat. 3. Would not the same dynamo operate a faradic coil with an automatic current breaker precisely as a battery does? A. Yes. 4. What percentage of corn is starch? A. The average quantity in flat American maize is 50½ per cent. In the flat white and yellow varieties 54¾ per cent is obtained. Indian corn contains 67·55 per cent of starch. 5. What proportion of the stock does a distiller succeed in converting, or how much starch remains unconverted? A. The amount distilled is limited only by the quality of the apparatus and perfectness of the method employed. 6. What is the reason for part of the starch remaining unconverted, or what stands in the way of total conversion? A. Theoretically, there is no reason why the entire amount of starch should not be converted, but practically there is always means of loss which cannot be avoided.

(65) J. E. asks: 1. What is the difference between a low pressure and a high pressure boiler? A. The old distinction was that in the low pressure engine the steam was exhausted into a condenser, and in a high pressure engine exhausted into the atmosphere. In the former the pressure of steam was usually from 25 to 40 pounds, and in the latter from 60 to 100 pounds; but the distinction of the two is of late years being worked out, as we have engines working under 80 to 100 pounds pressure which exhaust into a condenser. 2. Also for a work in that line. A. We would recommend to you Roper's Engineer's Handy Book, Haswell's Engineer's Pocket Book, and Perry's Elementary Treatise on Steam.

(66) O. Z. writes: 1. I have made an induction coil according to directions given in one of your SUPPLEMENTS, but instead of using the naked copper wire for the secondary coil. What is the cause? A. Possibly your wire is broken or short circuited. 2. I have constructed a battery on the Grenet principle; but it worked for about two hours, then it failed. A. A Grenet battery is not adapted to continued use. It runs down in a short time. 3. How much battery power would be required to work a small electric light (arc light carbons a quarter of an inch, and incandescent lamp of small size)? A. 20 to 25 cells of Bunsen battery will operate a small arc light. It requires from 40 to 60 cells to run an incandescent lamp.

(67) G. A. W. asks: Which is the strongest (that is, support the greatest weight)—a six inch solid iron column, or a six inch hollow column two inches thick? The length of the columns immaterial. A. The solid cylinder will sustain the greater load.

(68) J. D. B. asks: 1. With what velocity does air move to fill the vacuum created by the passage of lightning? And how fast would it move in a tube previously exhausted? A. The theoretical velocity of air flowing into a vacuum is 1347·4 feet per second. Into an exhaust tube it would flow with about 0·7 of the above velocity. 2. What is the best rule to determine the speed of vessels propelled against or from a current? A. For obtaining the actual speed of a boat in a current, add the velocity of the current to the shore rate when running against the current. Subtract the velocity of the current from the shore rate when running with the current. 3. What degree of heat would friction of the air cause on a smooth surface moving at the rate of 600 feet per second? A. We have no data as to the amount.

(69) W. O. M. asks: 1. Will wood expand by heat? A. We doubt if there is any practical expansion of wood by heat. 2. If water is running over wood, will the wood soak in any of the water? A. Yes.

(70) G. L. F.—For copper dipping solutions use 3½ ounces sulphate of copper, 3½ ounces sulphuric acid, 2 gallons of water. Dip no longer than to obtain a thin coat of copper. If left too long in the dip, the copper will be spongy and muddy, and will rub off. Another plan is to tumble the small work in saw dust wet with the above solution.

(71) E. L. D. asks: What metal will stand the most degrees of heat, and how many degrees it is? A. Platinum has a melting point of 2,600° Centigrade, or 3,080° Fahrenheit. The melting point of iridium may be slightly higher, but practically platinum is the highest-melting element.

(72) J. M.—The great trouble in hardening mill picks, especially the solid picks, arises from unequal heating. More picks are destroyed by overheating the corners than by anything in the nature of the hardening or the bath that they are hardened in. The lowest heat that will harden, in clear water with a little salt in it, is all that is needed. Never plunge the point into the fire, but heat from the eye. Leave the point in the cool part of the fire until the body is hot. If the hardening is well done, the pick should stand well with very little drawing of temper—only to a straw color.

(73) E. F. B. writes: In your SUPPLEMENT No. 425, page 6783, Feb. 23, 1884, is a cut of an incubator heated by electricity. Please tell me if the application is patented; if not, where can a thermometer be obtained with a cut-off attachment? A. The electrical incubator illustrated in the SUPPLEMENT is a German patent. We could not inform you whether it was patented in this country or not without making a search. For further information on incubators, etc., address Perfect Hatching Co., Elmira, N. Y.; A. M. Halstead, Rye, N. Y.

(74) G. V. A.—For gilt lettering upon wood print the letters upon the wood with yellow ink. Then brush gold bronze powder upon the printed work with a fur brush. The bronze will stick to the ink. Hard wood is more difficult to print upon than soft, and may require type of harder metal than ordinary. You may try it with printing type. You can get the yellow ink from a printer, and the gold bronze from a painter.

(75) S. G.—We fear that your photographic lens is of too short focus for a telescope. An object glass of the diameter that you name should be about 3 feet focus. If the lens is achromatic, it will make a very fair telescope if only 2 feet focus. For eye pieces, you will see a full description in SCIENTIFIC AMERICAN SUPPLEMENT No. 399.

(76) E. L. K.—The mounting of a parchment diploma may be done in the same manner as pictures or map work. Upon a clean sheet of paper lay the diploma face down upon a flat table; brush good, clear paste over the back evenly. Upon this lay a piece of thin white muslin a little larger than the parchment. Smooth the muslin down with the hand, and cover with one or two thicknesses of thick wool cloth or a blanket, and press with a flat board and a weight; let it dry over night, then trim the edge for framing.

(77) J. C. H. asks: 1. The number of cubic feet a ton of anthracite coal, chestnut size, should measure? A. For Lehigh coal, 40 cubic feet to a gross ton. For Lackawanna coals 42 to 45 cubic feet per ton. This is for egg size. Add 5 per cent for chestnut. 2. Is there any cheaper material with which ground or flocculent asbestos can be mixed and fashioned into sheets of a firm and stiff consistency, which will form a waterproof composition? And if so, and tanks of the same be made, what substance should be used to cement the laps at the corners? A. Asphalt melted with the asbestos, or shellac varnish makes good waterproof material, as is also paraffine. The first is the cheapest, and will probably give satisfaction.

(78) F. M. writes: I am troubled with using well water, and it is very salty; is there no remedy to make the water soft like rain water? A. We know of no remedy for well water that has salt in it. Water that is hard from lime may be made soft for washing purposes by soda, borax, or ammonia. Such water is not suitable for drinking. If you wish to obtain pure water for drinking, you can make a simple still and condenser. Blow air through the condensed water to make it palatable.

(79) M. L. W.—The stenograph or short hand reporting machine is a French invention, and may have been made in the United States. It has a telegraphic alphabet. Is described in Knight's "Mecbanical Dictionary," article "Stenographic Machine." Also back numbers of SCIENTIFIC AMERICAN SUPPLEMENT.

(80) R. H. L. asks where the most strain would come on the steel spokes of an expert Columbia bicycle, above or below the heel?—supposing the rider weighed about 150 pounds, and it being a 54 inch machine—and where when it was without rider? A. The greatest strain or tension upon the wire spokes will be in the same position whether the machine loaded or not, and is supposed to be at an angle of about 25° from the point of contact with the ground.

(81) R. H. K. asks: 1. How he can loosen the shutters on outside blinds without taking the whole thing to pieces? They have been stuck by paint, I suppose. A. If the paint cannot be cut out with a knife, you can take off the whole of the paint with strong potash. We think the only proper way is to take the shutters apart and ream out the holes, and scrape off the excess of paint from the leaves. 2. Also how to prevent a botany box from rusting? A. Clean your botany box thoroughly and paint with Prince's metallic paint and boiled linseed oil, and dry in the sun.

(82) W. J. A. writes: I have heard of a chemical or paint works in New York, in which not one of the employes (it is said) has died of consumption during a space of 25 years; it is also stated that persons going there to work afflicted with lung diseases have been completely cured. A. One of the oldest and largest paint manufacturers in New York thinks he heard some such report as you mention, years ago, about curative effect of work in paint and chemical establishments. He says it was obviously untrue so far as paint business was concerned, and it seemed to him, as it does to us, ridiculous as to chemical works, as it certainly would be if said in regard to white lead, zinc white, sulphuric acid, etc.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. C.—It is impossible for us to give information relative to ingredients of an iron ore, unless it be submitted to chemical analysis. The expense of such an examination would be about $15.00. From the appearance of the specimen received, we would hardly recommend you to have it analyzed.—A. M. F.—The sample is pyrite (iron sulphide) of no apparent value. —R. T. B.—No. 1 is a close grained silicious rock. No. 2 consists essentially of hornblende and mica. The specimens have no value for economic purposes as far as their metallic ingredients are concerned.—J. T. C.—The specimen is pyrite (iron sulphide) of no economic value except in the manufacture of sulphuric acid.—V. W. P.—The specimen is pyrite (iron sulphide). It may carry gold, and an assay costing $5.00 will be necessary to determine the value, if any.—B. A. B.—The specimen is known mineralogically as chalcopyrite. It is a mixture of copper and iron sulphides, and sometimes carries gold.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 13, 1884,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Alloys for safes, metallic, J. Farrel 298,365
Animal trap, P. R. Erling 298,361
Anvil, C. Fisher 298,567
Axle box, car, M. R. Carey 298,552
Bale tie, A. E. Russell 298,410
Bale tie, J. White 298,645
Band tucker, W. M. Kealen 298,389
Barrel trussing machine, J. Reid (r) 10,479
Bathing cabinet, folding, R. A. Horning 298,585
Beer and other alcoholic liquors, apparatus for preserving, C. E. Haynes 298,578
Bench dog, R. Doty 298,560
Billiard and pool bridge, G. Borst 298,342
Billiard table time register, E. B. Pope 298,402
Bit brace, C. H. Amidon 298,542
Black leading machine, G. E. Lloyd 298,595
Blast furnace bell and hopper mechanism, F. W. Gordon 298,370
Block. See Toy building block.
Blocks, stones, etc., making artificial, L. Rosenthal 298,505
Blower, rotary, J. L. Newman 298,492
Board. See Ironing board.
Boat. See Dumping boat.
Bobbin winder, G. W. Clapp 298,554
Boiler. See Steam boiler.
Boiler or vessel employed in the treatment of fibrous materials for the manufacture of paper pulp and for other purposes, I. S. McDougall .. 298,602
Boiler setting, W. T. Hildrup, Jr 298,380
Bolster plates, die for making, H. James 298,586
Room and gaff for vessels, E. Bangs 298,545
Boot, G. Valiant 298,638
Boot and shoe seam, G. Valiant 298,637
Boot or shoe, G. C. Buch 298,346
Boot or shoe, H. T. Marshall 298,599
Boot or shoe sole, A. J. Mott 298,610
Boot, rubber, J. Banigan 298,546
Box. See Axle box. Cash box. Paper box.
Box fastener, J. W. Harlow 298,689
Brace. See Bit brace.
Bracket. See Roofing bracket.
Bricks, tiles, etc., press for making, T. Whittaker 298,646
Bridge signal, draw, J. N. Williams 298,647
Brush, paint, J. Elliott 298,359
Buckle, J. W. Smith 298,511

Buckle, harness, H. C. Colton ... 293,351
Building, cold and fireproof storage. B. E. Valentine ... 298,522
Button, G. W. Prentice ... 298,403
Button fastener, W. Halkyard ... 298,464
Button fastener, R. Sanford ... 298,506
Button fastener, F. A. Smith, Jr ... 298,423
Button setting instrument, J. F. Atwood ... 298,333
Can and case, J. M. Bean ... 298,338
Car braces, gauge for cutting, C. Mattice ... 298,600
Car brake, M. M. Hiner ... 298,467
Car coupling, T. B. Buckman ... 298,445
Car coupling, E. H. A. Haupt ... 298,577
Car coupling, J. Ridenour ... 298,406
Car coupling, K. Smith ... 298,631
Car coupling, J. D. Smoot ... 298,513
Car coupling, J. A. Vogler ... 298,523
Car coupling, Washburn & Journeay ... 298,526
Car coupling link, D. Hayes ... 298,690
Car, stock, G. D. Burton ... 298,666
Cars, track rail attachment for replacing derailed, M. C. Woods ... 298,437
Cars with cables, device for coupling, J. C. Dolan ... 298,673
Card holder and exhibitor, S. L. Davis ... 298,354
Carpet stretcher, J. W. Thompson ... 298,519
Carpet stretcher, R. F. Truslow ... 298,521
Carpet sweeper, E. B. Clarke ... 298,349
Carriage apron, A. C. Holden ... 298,381
Carrier. See Cash carrier.
Cart, cotton and corn planter, and manure distributer, combined riding, A. J. Arrington ... 298,653
Cart, road, D. Argerbright ... 298,652
Cart, road, C. W. Saladee ... 298,415
Cartridge magazine, T. Nordenfelt ... 298,494
Cartridge shell, G. Kynoch ... 298,696
Case. See Paper, twine and sack case. Pencil case. Watch case.
Cash and parcel carriers, elevator for, A. T. Atherton ... 298,654
Cash box, folding, B. C. Foster ... 298,569
Cash carrier, R. Gornall ... 298,688
Cash carrier, O. B. Hall ... 298,373
Casting plumbers' traps, machine for, C. E. Heiss ... 298,580
Casting steel ingots, compression apparatus for, G. W. Billings ... 298,661
Centrifugal machine, T. H. Müller ... 298,395
Chain, flat, A. Vester ... 298,432
Chain wrench, W. H. Brock ... 298,442
Charm, watch, R. L. Allen ... 298,540
Charm, watch chain, F. T. Pearce ... 298,705
Check book for harness, back strap, W. N. Wilson ... 298,535
Chuck, lathe, E. L. Mansfield ... 298,488
Clasp. See Traveling bag clasp.
Clasp, C. C. Shelby ... 298,508
Clock, S. Diolot ... 298,557
Clock for machinery, speed, W. H. Lord ... 298,487
Clutch, friction, R. N. Ross ... 298,708
Clutch mechanism, B. F. Mohr ... 298,608
Coasting device, roller, P. M. Stevens ... 298,710
Cock and faucet, G. B. McCracken ... 298,394
Cock and sewer gas cut-off, compound water, W. Cahoon, Jr ... 298,347
Coffee, preserving the aroma of, M. F. Fowler ... 298,684
Coffin, J. V. Rowlett ... 298,409
Coin holder and deliverer, J. L. Donnelly ... 298,674
Collar, A. J. & N. L. McAdam ... 298,489
Collar coupling, horse, S. J. Bowers ... 298,343
Collar pad fastening, horse, J. Scherling ... 298,626
Condenser head for exhaust pipes of steam engines, W. C. Lyman ... 298,698
Condition-powder, White, Jr., & Anderson ... 298,433
Cooler. See Water cooler.
Cornstalk cutter, Atkinson & Phelps ... 298,655
Corsets, clasp fastening for elastic stays in, T. H. Ball ... 298,544
Cotton scraper and chopper, combined, C. J. Morrison ... 298,491
Counter stiffeners, machine for forming, G. T. Shepley ... 298,420
Coupling. See Car coupling. Shaft coupling.
Cuff fastener and adjuster, T. B. Willson ... 298,533
Cultivator, G. Moore ... 298,609
Cultivator, cotton and corn, T. H. Baird ... 298,334
Curtain fixture, F. G. Robbins ... 298,407
Curtain pole tip, J. Kroder ... 298,592
Cutter. See Cornstalk cutter. Tobacco cutter.
Damper regulator, F. Thompson ... 298,635
Dental foil condenser, R. S. Williams ... 298,717
Dental foil, wrinkling gold, R. S. Williams ... 298,716
Dental hand piece, H. Laurence ... 298,483
Derrick, A. Reitz ... 298,405
Draught equalizer, S. Ray ... 298,622
Drawer lock, E. G. Gory ... 298,460
Dredger, D. J. Gilchrist ... 298,573
Dredging, crushing, and washing phosphate rock, apparatus for, F. Brotherhood ... 298,443
Drier. See Fruit drier.
Drill. See Hand drill.
Dumping boat, M. S. Coleman ... 298,668
Dust pan, F. W. Carpenter ... 298,447
Egg and cake beater, A. C. Rex ... 298,503
Egg beater and dish, combined, W. B. Henderson ... 298,375
Electric call apparatus, individual, A. P. Howes ... 298,383
Electric lights, treating carbons for, T. A. Edison ... 298,679
Electric motor, regulator, C. G. Burke ... 298,550
Electric wires, skeleton arch for the support of, G. M. Hoag ... 298,692
Electro magnetic motor, C. A. Saxe ... 298,507
Elevator. See Hydraulic elevator. Water elevator.
Elevator gate, self-acting, S. J. Laughlin ... 298,482
End flate, wagon, H. H. Perkins ... 298,400
Engine. See Pumping engine. Rotary engine. Steam engine.
Envelope opener and paper cutter, C. E. Hochstetler ... 298,581
Exercising apparatus, J. M. Laflin ... 298,392
Extractor. See Nail extractor.
Eye shade, electric, L. K. Oppenheimer ... 298,397
Eyeglasses, J. P. Michaels ... 298,490
Eyelet, W. H. Rose ... 298,707
Farm gate, F. A. Peebles ... 298,620
Faucet for drawing beer and other liquors, P. Gardner ... 298,686
Feed cutting machine, J. Weichhart ... 298,527
Fence making machine, upright wire, J. M. Fultz ... 298,368
Fetter for animals, M. E. Burlingame ... 298,551
File and cabinet, letter, A. L. Colton ... 298,450
File cutting machine, C. Vogel ... 298,714
Firearm sight, E. L. Berthoud ... 298,659
Floor mat, F. Fastenrath ... 298,565
Folding table, O. A. Thayer ... 298,430
Foot power, H. Field, Jr ... 298,566
Forge, J. F. Winchell ... 298,718
Fork. See Hay fork.
Frog, wrecking, A. H. Palmerton ... 298,619
Fruit drier, J. B. Sweetland ... 298,713
Frying utensil, E. Bender ... 298,339
Furnace, O. Wilson ... 298,534
Furnace for the manufacture of metals direct from the ore, J. A. Stearns ... 298,426
Gauge. See Weatherboard gauge.
Gas, apparatus for generating and carbureting hydrogen, L. S. Groves ... 298,462
Gas by electricity, apparatus for lighting, L. S. White ... 298,531
Gate. See Elevator gate. End gate. Farm gate.
Gearing, differential, R. Lavery ... 298,697
Glass bricks, manufacture of, F. H. Shaw ... 298,418
Gold and silver from their ores, process of and apparatus for extracting, C. P. Bonnett ... 298,663
Grain binders, bundle carrier for, W. Collins ... 298,449
Grain drill force feed, J. H. Keedy ... 298,390
Grate bar, S. Smith ... 298,424
Guard. See Switch guard.
Gun, machine, T. Nordenfelt ... 298,493
Gun, magazine, L. L. Hepburn ... 298,377
Hammer, tack, G. S. Yingling *et al* ... 298,649, 298,650
Hammock support, G. E. Sutpben ... 298,515
Hand drill, I. M. Furbish ... 298,457
Handle. See Tool handle.
Hanger. See Shade hanger.
Harness, C. Kifer ... 298,590
Harness, hip strap loop for, A. Karras ... 298,589
Harvesters and binders, grain conveyer for, J. D. Nix ... 298,614
Hat rounding machine, J. Wenstrom ... 298,643
Hatching eggs by artificial heat, apparatus for, C. E. Hearson ... 298,579
Hayfork, horse, J. S. Gochnauer ... 298,574
Heel burnishing machine, I. Legay ... 298,484
Hermetic jar, T. Hetzler ... 298,378
Hinge for mirrors, A. Jelinek ... 298,386
Hinge, spring, G. M. Lane ... 298,480
Hoisting bucket, Miller & Goyette ... 298,606
Holder. See Card holder. Coin holder. Match box holder. Pen holder. Pneumatic holder. Tally card holder. Whip holder.
Hook. See Cbeck hook. Ladder hook.
Hook, F. A. Smith, Jr ... 298,510
Horse cleaning machine, C. S. & E. A. Conde ... 298,352
Horse tooth cutter, J. H. Dancer ... 298,556
Hose, adjustable shelf for holding fire, Guibert & Andrus ... 298,373
Hub attacbing device, G. H. Hombach ... 298,584
Hub, wheel, J. P. Warner ... 298,525
Hydrant and street washer, A. G. Daykin ... 298,355
Hydraulic elevator, E. B. Ellington ... 298,680
Ice creeper, J. J. Temple ... 298,517, 298,518
Ice making apparatus, retort for ammonia, M. S. Conly ... 298,669
Inductorium, C. J. Van Depoele ... 298,431
Inspector fluid, J. L. Hornig ... 298,469
Insulator, J. S. Lewis ... 298,593
Insulator pins, machine for turning, J. J. Baldwin ... 298,543
Insulator, terminal, J. S. Lewis ... 298,594
Ironing board, J. W. Smalley ... 298,422
Jack. See Lifting jack. Screw jack. Wagon jack.
Jar. See Hermetic jar.
Joint. See Steam pipe joint.
Jug, J. R. Graver ... 298,371
Ladder hook, J. F. Manahan ... 298,597
Ladder, portable, V. Béssier ... 298,660
Lamp socket, incandescent electric, S. Bergmann ... 298,658
Land roller, K. W. Jones ... 298,475
Lantern and wonder camera combined, magic, J. B. Upham ... 298,636
Lathe for turning polygonal forms, L. Weisse ... 298,528
Lathe, wood turning, L. Weisse ... 298,529
Lifting jack, M. R. Baldwin ... 298,385
Lifting jack, C. Fisher ... 298,568
Lifting jack, W. L. Hall ... 298,374
Lifting jack, O. K. McIntire ... 298,700
Lightning conductor, T. H. Dodge ... 268,357
Line stopper, J. Furguson ... 298,369
Liniment, S. Potter ... 298,706
Lock. See Drawer lock. Mail pouch lock. Padlock. Permutation lock.
Lubricator, Hope & Homan ... 298,468
Lubricator and measure, J. S. Peter ... 298,497
Lunch box, W. F. Berghofer ... 298,340
Mail pouch lock, G. Deimel ... 298,451
Mail sack tag, S. W. Brackett ... 298,345
Mat. See Floor mat.
Match box holder, W. N. Weeden ... 298,641
Match splints, making, C. B. Rawson ... 298,502
Measuring and cutting machine, cloth, E. L. Crosby ... 298,670
Measuring machine, grain, J. & A. Nafziger ... 298,612
Measuring vessel, liquid, M. F. Robinson ... 298,504
Mechanical movement, J. W. Dodge ... 298,671
Mechanical movement, G. S. Hensley ... 298,376
Mechanical power, J. C. Sellers ... 298,628
Middlings purifiers and roller mills, automatic shelf feeder for, W. M. Jewell ... 298,387
Mill. See Windmill.
Mills, electric work indicator for, A. D. Blodgett ... 298,341
Millstone dressing machine, D. S. Greely ... 298,461
Motor. See Electro magnetic motor. Spring motor.
Nail extractor, H. W. Fowler ... 298,683
Necktie and collar button, combined, A. L. Gilbert ... 298,458
Night light, S. Clarke ... 298,448
Nut beating, adjustable, G. Edmonds ... 298,563
Oar, S. Lindenberger ... 298,485
Oiler, A. J. Spicer ... 298,514
Oils, apparatus for reducing, refining, and separating hydrocarbon, E. W. Strain ... 298,712
Ornaments from metals, etc., producing, W. C. Edge ... 298,358
Packing salt, flour, etc., machine for, R. Radley ... 298,501
Padlock, C. W. Judson ... 298,476
Paints, package for mixed, Mason & Bergman ... 298,393
Paper box, J. C. Hurd ... 298,384
Paper creasing machine, J. E. Stannard ... 298,425
Paper machine, T. Stewart ... 298,634
Paper perforating device, C. Carlton ... 298,667
Paper rolls, end cap for, F. W. Dunnell ... 298,562
Paper, twine, and sack case for grocers, etc., J. F. Barr ... 298,656
Paper weight and pen rack, combined, I. W. Heysinger ... 298,379
Parer, potato, G. A. Betancourt ... 298,547
Patterns on goods, device for clamping, House & Dimond ... 298,470
Pen, fountain, J. Holland ... 298,582
Pen, fountain, G. C. Holt ... 298,382
Pen holder, A. E. Sage ... 298,411
Pen rest, C. McKinnon ... 298,603
Pencil case, L. W. Fairchild ... 298,364
Pencil case and lead, J. Holland ... 298,583
Permutation lock, J. W. Allen ... 298,651
Piano sounding boards, agraffe for, C. W. Brewer ... 298,664
Pipe. See Water pipe.
Pitman, Miller & Diehl ... 298,701
Planters, reel for check row corn, Dupee & Housum ... 298,678
Pliers, cutting, J. H. Jencks ... 298,587, 298,588
Plow and barrow, combined, E. O. Long ... 298,486
Plow, sulky, S. W. Barr ... 298,337
Pneumatic holder and cutter, combined, J. R. Williams ... 298,715
Portfolio, Williams & Shipman ... 298,532
Power. See Foot power. Mechanical power.
Power, apparatus for transmitting, P. A. Dohis ... 298,672
Pressure regulator, J. F. Gooding ... 298,687
Printer's quoin, C. A. R. L. Ver Genius ... 298,639
Projectile, submarine, J. Ericsson ... 298,455
Pruning shears, J. G. Buback ... 298,548
Pump and ice box, ale, W. Gardner ... 298,572
Pump for portable steam engines, steam, W. C. Wolfe ... 298,435
Pumping engine, steam, J. L. Lowry ... 298,596
Punching machine, check, J. N. Williams ... 298,648
Quarrier and stone shaper, rotary, Crump & Brereton ... 298,353
Railway joint and nut lock, W. M. Jenkins ... 298,473
Railway rails to metallic ties, securing, S. B. Wright ... 298,539
Railways, constructing tubes and roadbeds for cable, J. D. Isaacs ... 298,472
Rain water trap, E. T. Toomer ... 298,520
Reflector support for candles, A. Konetzny ... 298,478
Register. See Billiard table time register.
Regulator. See Damper regulator. Pressure regulator.
Rockdrill carriage, W. L. Saunders ... 298,625
Roller. See Land roller.
Roofing bracket, A. Guedie ... 298,463
Rotary engine, J. W. Wilks ... 298,434
Ruler, nautical parallel, C. Hutchinson ... 298,471
Sash cord guide, G. W. Pero ... 298,496
Saw, J. Smith ... 298,709
Saw jointer, H. D. Wolcott ... 298,538
Scraper, road, C. Mendenhall ... 298,604
Screen. See Window screen.
Screen for attrition mills, etc., T. L. Sturtevant ... 298,428
Screw, H. A. Stone ... 298,427
Screw jack, Norris & Neil ... 298,704
Seal, lead and wire, E. J. Brooks ... 298,665
Seam strengthener, gusset, and fly, combined, J. F. Ensminger ... 298,360
Seed huller, cotton, H. Heard ... 298,466
Seed, treating cotton, J. F. O'Shaughnessy, 298,617, 298,618
Seeder and fertilizer distributer, combined, G. W. White ... 298,644
Separating liquid from solid matter, and mechanism therefor, H. Warden ... 298,640
Sewing machine bobbing winder, H. M. Dixon ... 298,558
Sewing machine brake, E. H. Amet ... 298,541
Sewing machine, buttonhole, D. Mills ... 298,607
Sewing machine hat binding attachment, G. W. Parkinson ... 298,399
Sewing machine quilting attachment, Houck & Smith ... 298,693
Shade hanger, adjustable, J. Wagner ... 298,524
Shaft coupling, J. H. Osborn ... 298,398
Shaft support, J. F. Pace ... 298,495
Shears. See Pruning shears.
Shingle planing machine, A. W. Eldredge ... 298,454
Shirt bosom protector, C. S. Kellogg ... 298,391
Shoe, T. R. Evans ... 298,363
Shoe, rubber, F. M. Shepard ... 298,419
Shutter worker, T. A. Myers ... 298,702
Sifter, corn, J. Taylor ... 298,429
Signal. See Bridge signal.
Slate frame, O. M. Pond ... 298,499
Sleigh, W. H. Winne ... 298,536
Smoothing and polishing material, R. S. Jennings ... 298,474
Snow plow, P. B. Brazel ... 298,441
Spinning machines, saddle for the top rolls of, H. L. Pierce ... 298,621
Spring. See Vehicle spring. Wagon spring.
Spring motor, A. Kanthack ... 298,388
Staying piece for garments, G. W. Pine ... 298,401
Steam boiler, P. F. Dundon ... 298,561
Steam engine, compound, W. L. Shepard ... 298,630
Steam pipe joint for rotary paper drying cylinders, etc., M. J. Roach ... 298,624
Steel ingots, pouring and compressing, G. W. Billings ... 298,662
Steel, manufacturing wrought, S. T. Wellman ... 298,642
Stereotype or electrotype plates, mounting, R. W. Nelson ... 298,703
Stone crandall, sand, F. Schueddig ... 298,417
Stone dressing machine, J. Mann ... 298,598
Storage battery element, W. E. Case ... 298,348
Stovepipe shelf, F. A. Gardner ... 298,685
Stove, range, furnace, etc., W. Miggett ... 298,605
Strap fastener, J. W. Ropp ... 298,408
Switch guard, safety, H. Harmer (r) ... 10,478
Switch stand, J. B. Witty ... 298,537
Table, S. W. Maxson ... 298,601
Tag, J. C. St. John ... 298,711
Tag fastener, G. N. Buck ... 298,549
Tag fastener, S. S. Sencenbaugh ... 298,629
Tag, pin, O. J. Cohn ... 298,555
Tally card holder, R. L. French ... 298,367
Tea kettle, I. W. Harlow ... 298,465
Telegraph, quadruplex, G. W. Gardanier ... 298,571
Telephone exchange apparatus, T. B. Doolittle ... 298,559
Telephone, mechanical, A. B. Kurtz ... 298,479
Telephone transmitter, D. Drawbaugh ... 298,676
Telephone transmitter, G. W. Drawbaugh ... 298,677
Thill coupling, A. O. Bonsteel ... 298,439
Tobacco cutter, G. A. Priest ... 298,404
Tool, J. A. Sherman ... 298,421
Tool handle, J. P. Johnson ... 298,695
Toy, F. W. Carpenter ... 298,446
Toy building block, E. H. Snow ... 298,633
Toy horse, trundling, E. J. B. Whitaker (r) ... 10,480
Toy revolving bell, W. Goodfellow ... 298,575
Trap. See Animal trap. Rain water trap.
Traveling bag clasp, W. J. Large ... 298,481
Trimming, dress, A. Hirsch ... 298,691
Truck and elevator, barrel, H. E. Gilchrist ... 298,459
Truck and step ladder, combined, A. H. Barnes ... 298,336
Trunk, J. B. Duguid ... 298,453
Type writing machine, E. J. Hall ... 298,576
Valve, balanced slide, W. G. Smith ... 298,512
Valve gear, steam engine, B. Arnold ... 298,438
Valve, steam actuated, G. E. Elliott ... 298,681
Vegetable slicer, M. Reichert ... 298,623
Vehicle, side bar, J. Taylor ... 298,516
Vehicle spring, E. P. Carter ... 298,553
Vehicle, two-wheeled, C. W. Saladee, 298,412, 298,413, 298,414, 298,416
Vehicle wheel, F. L. Kirkbride ... 298,591
Vehicle wheel, L. A. Powers ... 268,500
Vehicle wheel, M. L. Smith ... 298,632
Vessels with phosphate rock, etc., loading, F. Brotherhood ... 298,444
Wagon jack, G. B. Clark ... 298,350
Wagon running gear, W. H. Fanning ... 298,564
Wagon running gear, A. Womack ... 298,436
Wagon skein, C. Pierce ... 298,498
Wagon spring, C. Fallesen ... 298,456
Washing machine, J. Newman ... 298,613
Washing table cutlery, etc., machine for, A. E. Wetmore ... 298,530
Watch case, D. O'Hara ... 298,615
Watch case, H. G. Skidmore ... 298,509
Watch case pendant, D. O'Hara ... 298,396, 298,616
Water closet cistern, J. Demarest ... 298,452
Water cooler, E. B. Jewett ... 298,694
Water elevator, D. S. Boyakin ... 298,344
Water pipe, straight, J. F. Bennett ... 298,657
Waterproof, rendering goods and fabrics, R. S. Forbes ... 298,366
Water wheel, J. Kellams ... 298,477
Weather board gauge, D. H. Finch ... 298,682
Wheel. See Vehicle wheel. Water wheel.
Whip bolder, H. Schoby ... 298,627
Whip socket, W. F. Dinse ... 298,356
Windmill, J. B. Foster ... 298,570
Window, A. Matuska ... 298,699
Window screen, T. W. Dowling ... 298,675
Window shade rollers, gudgeon for, J. Munger ... 298,611
Wire, barbed, C. B. Brainard ... 298,440
Wire stretcher, T. Huston ... 298,385
Wires, machine, for manufacturing bottle, M. V. B. Ethridge ... 298,362
Wrench. See Chain wrench.

DESIGNS.

Candles, ornamentation of, F. Baumer ... 14,995
Costume, girl's, C. Shiels ... 14,999
Curtain, J. Sweeney ... 15,000
Harness ornament, D. C. Lockwood ... 14,998
Knit shirt, S. Condé ... 14,996
Skirt, lady's walking, L. Tully ... 15,001
Stove, parlor, W. P. Warren *et al* ... 15,002
Watch case, J. C. Dueber ... 14,997

TRADE MARKS.

Cigars, C. Palacio & Co ... 11,187
Corsets, stiffening ribs or bones for, F. D. Marckwald ... 11,179
Embroidery silk, J. Pearsall & Co ... 11,183
Horse blankets, Newichawanick Company ... 11,180
Pipes, fittings, and plumbers' supplies, Reuter & Mallory ... 11,184
Soap, laundry, J. S. Kirk & Co ... 11,178, 11,185, 11,186
Spool cotton, Clark Thread Company ... 11,176, 11,177
Tin cans, hand made, Can Makers' Mutual Protective Association ... 11,175
Tobacco, smoking and chewing, P. H. Mayo & Bro ... 11,182
Wire rods, flat steel strips, hoop iron and steel, and similar half products of iron and steel, E. Boecking & Co ... 11,181

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