with, laid in a wooden box? A. Yes. Use the fine light ashes from behind the bridge wall. It is the best. If not enough, sift the ashes under the grate, using the fine ash.

(12) A. P.—A method of making malleable iron casting is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 399, and a very complete account in Spons' Workshop Receipts, third series, which we can mail for $2.00.

(13) W. T.—The finishing cuts on the ends of pencils are made with a pair of sharp knives that work like scissors, but do not meet. The knives are in a machine, the pencils being passed through automatically.

(14) C. E. L.—There are several telescopic comets within or near the solar system now. The one recently discovered at the Lick Observatory can be seen with small telescopes as a small star with a faint tail about half a degree long. Its position on the 17th November was R. A. 3 h. 57 m., dec. south 2° 30′. It is computed to be visible during one year, in the evening, until March, 1889, then in the morning and evening until November, 1889.

(15) A. McC. — The steepest railway grades are said to be in Switzerland, 369 feet to a mile. Many railways have short grades of 200 or more feet to a mile. The momentum of a locomotive and train will enable the ascent of very steep grades that are short. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 395.

(16) G. W. H.—The expansion of steam pipe for a rise of temperature of 200° is 1⅛ inches per 100 feet or 1·97 inches for 130 feet. This is for a change from 60° to steam heat of 20 pounds pressure. For a pressure of 50 pounds add three-tenths of an inch per 100 feet. All sizes of pipes expand alike with equal change in temperature.

(17) G. C. S.—The outer planets take their apparent retrograde motion from their position in opposition to the earth, when the earth, moving faster in its orbit than the motion of the planets, makes their motion apparently backward among the stars. You will notice this only by close observation when an outer planet is near opposition. The time and amount varies for the different planets. See "Popular Astronomy," by Newcomb, $2.50, which we can mail.

(18) A. O. asks: Does a horse travel with less fatigue over a flat than a hilly country? A. The theory that the ease of down hill travel compensates for the difficulty of going up hill is a great mistake. Holding back is not natural for a horse; it often worries him more than an uphill pull.

(19) R. C. G. asks the way to line a shaft. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 190.

(20) W. A. asks: What sizes of wire will be required to supply currents for separate plants of three, six, and twelve arc lamps? A. In general terms, the larger the wire, the better. No. 8 or 10 wire suffices.

(21) C. G. writes: 1. What causes a show window to "perspire," as they say? A. The condensation of moisture from the air, largely due to the gas burners and presence of people. 2. How can it be prevented? A. By ventilating at the top thoroughly.

(22) J. C. S. writes: A owes B $500.00, all of which he is unable to pay at once, and B agrees to extend the time twelve months, provided A will pay him part of the principal and interest in advance on the unpaid part at the rate of 8 per cent. A accepts this proposition and pays B $200.00, which is part principal and interest on the unpaid part. How much will A owe B at the expiration of twelve months? A. Let x = unpaid portion of principal, then $500 - x$ = paid portion. We then have the equation—

$$500 - x \times 0{\cdot}08\, x = 200.$$

Solving this, we find:

$$x = \$326.09.$$

This is the portion of the principal that is to be paid at the end of twelve months. In addition to this, 8 per cent has to be paid on the rest of the principal, or on $500 - 326.09 = 173.91$. Eight per cent on 173.91 is 13.91. Adding this to 326.09 we have 340.00 as the total to be paid at end of twelve months.

(23) W. J. L.—The piston of a moving engine travels forward and backward in its relation to the cylinder. It always moves forward in its relation to the roadbed or track when the engine is running forward, and always backward when the engine is running back.

(24) M. S. asks if a good grafting wax can be made sufficiently soft in consistency to be applied when grafting without requiring heat. A. Mix equal parts of beeswax and resin; add tallow until a proper consistency is attained.

(25) A. W. asks: About what is the market value of attar of roses? A. From $40 to $100 per ounce is given as the range of price.

(26) F. P. asks: 1. How can I mix kerosene and lard for a lubricating oil, so that it will not separate? A. Wash the lard well with hot water, have perfectly dry, and it will mix with kerosene. 2. Would it injure drinking water to use a copper pail? A. Not if the pail is kept bright. For Vesuvium, see SCIENTIFIC AMERICAN, Dec. 8, 1888, query No. 9.

(27) F. S. M. writes: I have an electric bell arrangement in my house, and the zinc rod in the battery gets coated with a kind of salt, and occasionally the battery refuses to work until I scrape the zinc. How can I prevent it? A. Add a little hydrochloric acid to your solution. The porous cell is probably exhausted and needs replacing.

(28) A. C. M. asks: Could I not charge a storage battery by means of a dynamo run by a windmill, by using an automatic arrangement that would complete the circuit only when energy greater than that in the storage battery was being developed by the windmill? A. You could construct an automatic arrangement based on the gas evolved when the battery is fully charged. A single cell could be sealed, and the pressure of gas in it could be made to actuate a mechanical cut-off when the pressure reached a definite point. This would provide for cutting off the current. It might be arranged to do the whole work of throwing in and out of circuit.

(29) G. F. writes: I have a mixture of white castile soap and eggs, which looks like soft soap. Could you tell me of something that would "cut" the soap, *i. e.*, take the greasy look out of it, and make it so it will not be stringy, but be in separate particles? A. A little salt solution will tend to make the soap curdle and form in clots.

(30) J. B. asks: 1. Is not hot air a better supporter of combustion than cold air? A. It tends to increase the engery of combustion, and to produce a much higher temperature. 2. Give a scientific explanation of how sparks get out of the fire box of a locomotive. Is not the creation of a vacuum in front end the cause? A. The creation of what is termed a "partial vacuum" is the cause.

(31) R. A. R. asks: Can you give me a recipe for making a preparation that will keep the frost off windows? A. Ventilate the window casing at the top. Sponge the windows with glycerine and water.

(32) A. S. writes: I have read somewhere that you can extend the carbon surface of a porous cup battery by packing powdered coke around the porous cup. Will you please tell me if the coke should be just poured around loose or be packed in tight. A. Break coke to size of beans, screen out dust, and pack loosely. For description of telephone, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 142.

(33) S. M. D. asks: 1. Have not inventors in the United States done more to develop modern practical scientific appliances than inventors in any other single country in the world? A. United States patents exceed in number those of any other country. 2. Have scientific men in Great Britain or France done more to develop theoretical and technical science than the same class of men in any other single country? A. It is impossible to answer your second query.

(34) Carpenter asks: 1. About what year were "cut" nails first introduced? A. The first patent for a machine for "cutting nails" was issued to Josiah G. Peerson, of New York, March 23, 1794. As early as 1606 Sir Davis Bulmer obtained a patent for cutting nails from a rod by water power. 2. What is the name of the wood from which Cuban cigar boxes are made? It much resembles mahogany, but lighter and softer. A. Spanish cedar.

(35) Reader writes: In your paper of November 24, 1888, page 325, appears a table of the number of gallons of water in cylindrical cisterns. The estimates given in this table differ from a table on page 695 of Moore's "Universal Assistant." I would like to know which is correct. Please answer in your next paper. A. The *Sanitary News* table refers to the imperial gallon of 277·274 cubic inches. Moore's table refers to the American gallon of 231 cubic inches.

(36) R. D. asks: 1. How long will an open circuit battery (best make) ring a bell continuously before it becomes polarized, and how long will a closed circuit battery do the same before it runs down? A. It depends on the resistance of the bell magnet and on the general features of its construction and on the size of battery. Ten minutes to one hour for the open circuit, and ten hours and upward for closed circuit. 2. Which line will a battery run the longest on ringing a bell continuously, one a mile long or one 1 foot long, using the same size wire and the same bell in each case? A. If the bell and battery are properly proportioned, it will run longest on the short line.

(37) T. A. M. C. V. asks: 1. What is the pattern of Bunsen cell that may be used for charging accumulators, its size and capacity, and its intensity in amperes? A. The so-called Bunsen cell generally contains a carbon prism in the center, within a porous cup, which is surrounded by a plate of zinc, bent into a nearly complete circle. For the porous vessel, electropoion fluid, often described by us, is used. For the outer cell, water or dilute sulphuric acid. Such cell gives about 2 volts electromotive force, and its resistance may vary from 0·200 to 1 ohm, according to size, strength of solution, etc. With low external resistance, therefore, it may give 10 amperes. 2. What is the rule to calculate the number of such Bunsen cells required to charge an accumulator or several of them of two volts E. M. F.? A. Always arrange storage batteries in series for charging. Then for intensity of current allow 18 amperes, and for electromotive force allow 2·25 volts, or about 40 watts, per cell. If charging with a battery, arrange it so as to produce this current. 3. Is it necessary that a dynamo should have the same voltage and amperage as the accumulator for the purpose of charging, provided the number of watts be the same? Or may the voltage of the dynamo be lower, provided the amperage be higher? Can a dynamo of $4\frac{5}{16}$ amperes and 100 volts charge an accumulator, as good as one of 6 amperes and 75 volts, or 10 amperes and 45 volts, and making all of them the same combination in watts? A. The dynamo should have 12½ per cent more voltage, and should produce a current of 18 amperes intensity. The voltage and amperage cannot compensate, one for the other. The above rate is the correct one. More voltage would be uneconomical, and less amperage would be slow. Hence the third dynamo named would be the best, and should be given not less than $\frac{45}{2\frac{14}{16}}$, or 20 storage cells in series to charge.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

November 27, 1888,

AND EACH BEARING THAT DATE.

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

Acid, manufacture of phosphoric, Giles & Shearer ... 393,428
Acids of phenols, etc., production of iodized sulpho, E. Ostermayer ... 393,388
Alarm. See Choke-up alarm.
Arc light, D. B. Turner ... 393,405
Asphalt pavements, manufacture of, C. A. Case ... 393,616
Bag. See Mail bag. Moth proof bag.
Bag holder, A. D. Wallace ... 393,407
Bailer, G. W. Rose ... 393,485
Baling press, J. H. Gardner ... 393,697
Barrel setting-up machine, M. E. Beasley *et al* ... 393,683
Barrel, swing, C. C. Hiatt ... 393,705
Barrels, machine for setting up, G. M. Newhall ... 393,571
Batteries, porous cup for galvanic, H. J. Brewer ... 393,353
Battery. See Galvanic battery. Secondary battery. Storage battery.
Bed bottom, S. J. Dickson ... 393,547
Bed, folding, M. F. Koch ... 393,708
Bell, electric, A. Lungen ... 393,710
Bicycle, H. Brown ... 393,417
Blotting device or pad, S. S. Cole ... 393,359
Blower for boiler furnaces, T. H. Champion ... 393,357
Board. See Multiple switch board.
Boiler furnace, J. A. Palmer ... 393,579
Book, J. M. Rose ... 393,664
Book, account, J. W. Horne ... 393,507
Book, blank, J. W. Horne ... 393,506
Book holder, E. H. Roys ... 393,521
Book support, J. W. Coultas ... 393,542
Book support or holder, R. S. Kirkpatrick ... 393,649
Boot or shoe shank stiffener, T. Green ... 393,468
Boot or shoe tree, S. Mawhinney ... 393,514
Boots or shoes, tool for burnishing, J. H. Busell ... 393,537
Bottle, E. Storm (r) ... 10,969
Bottles, machine for washing lager beer, H. F. Ward ... 393,675
Box. See Letter box. Paper box. Post office box.
Boxes, machine for making, J. R. Stout ... 393,404
Bracket. See Scaffold bracket.
Brake. See Car brake. Pressure brake. Railway brake. Sled brake. Vehicle brake.
Breastpin, A. Young, Jr ... 393,413
Bretzel or cracker sizing and salting machine, D. R. & W. A. King ... 393,474, 393,475
Brick kiln, W. L. Gregg ... 393,641
Bridge connection truss, H. S. Hopkins ... 393,433
Bridle attachment, N. Edwards ... 393,695
Bridles, blinder loop for, T. A. Pramhus ... 393,658
Brush, scrubbing, T. H. Saunders ... 393,522
Buckle, G. E. Schellinger ... 393,663
Burglar alarm indicator, electric light, Packer & Cochran, Jr ... 393,657
Button setting machine, E. H. Taylor ... 393,730
Buttons, making lacing, E. Revol ... 393,721
Buttons to corsets or other garments, attaching, M. P. Bray ... 393,687
Calculating machine, C. Lorenz ... 393,478
Calendar stand and pad, H. H. Unz ... 393,528
Camera. See Photographic camera.
Camera, E. W. Sweigard ... 393,729
Camera shutter, F. Burrows ... 393,500
Can. See Sheet metal can.
Cant hook, D. Moran ... 393,384
Car brake, H. S. Hopper ... 393,561
Car brake, Reynolds & Gerdom ... 393,722
Car brake, railway, J. E. Robinson ... 393,587
Car coupling, S. Cooley ... 393,693
Car coupling, Dawson & Cleveland ... 393,545
Car coupling, A. C. Howes ... 393,370
Car coupling, R. F. Osborn ... 393,446
Car coupling, W. A. Post ... 393,660
Car coupling, G. M. Robbins ... 393,393
Car coupling, H. W. Warner ... 393,492
Car, railway, A. M. Leinwather ... 393,709
Car wheel flask, J. J. Carr ... 393,615
Cars, apparatus for heating and lighting railway, W. Wilson ... 393,599
Cars, apparatus for propelling, L. Paget ... 393,572
Cards, book for holding playing, F. Hebbard ... 393,432
Carriage curtain fastener, A. G. Snell ... 393,592
Carriage, trick, J. F. Byrnes ... 393,689
Carriages, gear iron for, J. F. Fallon ... 393,549
Carving fork, W. W. Lee ... 393,510
Carving fork, M. W. Moakley ... 393,715
Case. See Cigar and cigarette case. Toilet case.
Casting axle boxes, mould for, W. W. Ayres ... 393,349
Castings, making iron, G. G. Mullins ... 393,443
Catamenial sack, W. S. Watson ... 393,408
Chain, drive, J. A. Stone ... 393,490, 393,491
Chart, garment, E. M. Goldsmith ... 393,552
Chlorine, apparatus for obtaining, E. Solvay ... 393,672
Choke-up alarm, S. F. Wolff ... 393,412
Cigar bunches, making, J. E. Smith ... 393,726
Cigar fillers, blank for, J. E. Smith ... 393,727
Cigar or cigarette case, A. J. Needham *et al* ... 393,445
Cigar rolling or wrapping machine, C. W. Bowman ... 393,609
Cigarette machine, Kjollerfeldt & Kolnotsch ... 393,650
Clamp. See Hose clamp.
Cleaner. See Grain cleaner.
Clipper, hair, J. K. Priest ... 393,450
Clock pendulum regulator J. H. Gerry ... 393,638
Clocks, electric striking attachment for, J. H. Gerry ... 393,637
Closet. See Earth closet. Water closet.
Cloth cutting machine. C A Yost ... 393,495
Clover huller, H. Burfeind ... 393,613
Cold surface covering, C. B Manville ... 393,441
Condenser, ejector, L. Schutte ... 393,488
Confections, machine for moulding, J. C. Ruby ... 393,685
Conveyers, machine for bending spiral, W. W. Green ... 393,505
Cotton gin, P. L. & W. Brady ... 393,352
Cotton press, Loyall & Moyers ... 393,513
Coupling. See Car coupling. Thill coupling. Whiffletree coupling.
Crusher. See Rock crusher.
Cultivator, C. M. & C. D. R. Sandberg ... 393,667
Cutter. See Paper cutter. Stalk cutter. Tobacco and cigar cutter. Weed cutter.
Damper, pipe, R. Baile ... 393,498
Dash pot, J. D. Cite ... 393,690
Desk, folding, Eden & Guthrie ... 393,364
Digger. See Potato digger.
Dish washer, L. Sloan ... 393,671
Door check, pneumatic, T. Goodenough ... 393,429, 393,430
Door lock and attachment, W. D. Hughes ... 393,648
Door opener, electric, A. Lungen ... 393,711
Dredger dipper, M. C. Lawton ... 393,439
Drilling or boring machines, friction feed for, G. S. Walker ... 393,674
Drums, apparatus for mechanically playing on, A. Foerster ... 393,551
Drying apparatus, E. Theisen ... 393,594
Earth closet, H. J. Behrens ... 393,609
Edge shave, A. Schillmoller ... 393,487
Egg package, A. S. Hoyt ... 393,564
Electric circuit controller, W. J. Paine ... 393,389
Electric depositing cell, L. L. Smith ... 393,526
Electric light regulator, L. Paget ... 393,571
Electric machine and electric motor, dynamo, W. P. Freeman ... 393,636
Electric machine, dynamo, W. W. Griscom ... 393,469
Electric motor, Keller & Carnes ... 393,373
Electricity by secondary batteries, distribution of, W. W. Griscom ... 393,470
Elevator safety device, J. W. Dustin ... 393,425
Elliptic spring, Morris & Lawrence ... 393,569
Engine. See Hot air engine. Pressure engine. Rotary engine. Steam engine. Steam or pneumatic engine.
Evaporator, W. S. Gilmore ... 393,699
Explosive and making the same, A. Favier ... 393,634
Extension handle, J. P. Lybarger ... 393,377
Extractor. See Stump extractor.
Fabric. See Knitted fabric.
Feed water heater. J. T. Lee ... 393,375
Feed water heater, Pratt & Wainwright ... 393,453
Feed water regulator, Cook & Thoens ... 393,621
Feed water regulator, automatic, P. J. Duff ... 393,623
Fence, R. W. Fuller ... 393,504
Fence machine, S. J. White ... 393,732
Fence wire, machine for splicing, A. De Witt ... 393,423
Fences, machine for constructing, J. M. Mangold ... 393,651
Filing away printed clippings, etc., device for, C. W. Taylor ... 393,455
Filter press, L. A. Enzinger ... 393,633
Firearm, magazine, Von Stepski & Sterzinger ... 393,406
Firearms, safety holder for, C. C. B. Whyte ... 393,677
Fire extinguisher, W. P. Bending ... 393,606
Fire kindler, W. R. Myers ... 393,570
Firemen, life-saving harness for the use of, G. F. Griffin ... 393,555
Flask. See Car wheel flask.
Food compound, H. T. Champney ... 393,459
Foot rest and kneeling stool, combined, E. W. Jeffries ... 393,472
Fork. See Carving fork.
Frame. See Harvester frame.
Fuel, artificial, J. A. Freeman ... 393,427
Furnace. See Boiler furnace. Hydrocarbon furnace.
Furnace, W. D. Dickson ... 393,362
Furnace, F. Wild ... 393,409
Gauge. See Pressure gauge.
Galvanic battery, J. L. Gethins ... 393,639
Galvanic battery, H. L. Roosevelt ... 393,395
Garment supporter, J. N. Faust ... 393,550
Gas apparatus. Rennyson & Burgess ... 393,662
Gas holder. T. F. Rowland ... 393,724
Gas lighting and extinguishing apparatus, automatic, N. H. Shaw ... 393,525
Gas protective extinguisher, natural, C. E. Scribner ... 393,396
Gas retort lid, Z. L. Chadbourne ... 393,617
Gate. See Railway safety gate.
Generators, regulation of alternate current, G. Pfannkuche ... 393,448
Generators, regulator or cut-off for, D. W. Smith ... 393,590
Grading and ditching machine, W. J. Edwards ... 393,467
Grain cleaner, J. C. Fisher ... 393,635
Grain drill hoe, C. E. Patric ... 393,330
Grain separator, P. S. Willis ... 393,411
Grapple, W. H. Wiley ... 393,680
Grinding machine for cutlery, H. A. Axtell ... 393,497
Guitar, Durkee & Becker ... 393,694
Guns, carriage for machine, T. Nordenfelt ... 393,386
Guns, indicator for magazines of, W. R. Miller ... 393,653
Handle. See Extension handle. Soldering iron handle.
Harrow, sulky, T. G. Cook ... 393,692
Harvester, C. F. Search ... 393,397
Harvester frame, J. Miller ... 393,383
Hat or bonnet holder, N. E. Veatch ... 393,595
Heater. See Feed water heater.
Heating air, steam, etc., apparatus for, W. H. Coleman ... 393,540
Hinge, spring, F. R. Bartlett ... 393,350
Hinge, spring, N. Linsley ... 393,376
Hoisting and traversing apparatus, N. C. Harris ... 393,643
Holder. See Bag holder. Book holder. Gas holder. Hat or bonnet holder. Pencil holder. Sash holder. Sponge and slate pencil holder. Tidy holder. Tool holder. Twine holder.
Hook. See Cant hook. Sash lifting hook.
Hook, J. C. Newey ... 393,656
Hose clamp, E. L. Sharpneck ... 393,400
Hot air engine, T. J. Rider ... 393,663, 393,723
Huller. See Clover huller.
Hydraulic transit, J. E. Robinson ... 393,585
Hydraulic transit apparatus, J. E. Robinson, 393,584, 393,586
Hydrocarbon furnace, J. S. Andrews ... 393,415
Indicator. See Burglar alarm indicator. Station indicator.
Induction coil, coin-operated, C. Durieux ... 393,624, 393,625
Iron ores, reducing, M. Graff ... 393,554
Ironing table, wash bench, and step and extension ladder, combined, A. Hawkins ... 393,369
Jack. See Lifting jack.
Joint. See Pipe joint. Railway joint.
Kiln. See Brick kiln.
Knitted fabric, W. & R. N. Wrightson ... 393,734
Ladder and ironing board, combined step, P. Smith ... 393,591
Lamp, electric arc, G. Pfannkuche ... 393,447
Lamp globe, electric, S. Heimann ... 393,704
Lamp, incandescing electric, E. H. Johnson ... 393,478
Lamp socket, incandescent electric, Wollin & Werline ... 393,753
Lamps, filament for incandescent, G. S. Ram ... 393,391
Lantern, signal, Cogley & Kendig ... 393,460
Lasting machine, I. Frechette ... 393,503
Latch and lock, combined, J. Maynard ... 393,379
Leather graining machine, M. M. Scott ... 393,486
Leather staking machine, P. H. Daley ... 393,544
Letter box, electric, C. F. Harms ... 393,555
Level and straight edge, spirit, J. W. W. Clark ... 393,539
Lifter. See Transom lifter.
Lifting jack, H. H. Clever ... 393,358
Lifting jack, W. O. Nease ... 393,385
Lifting jack, C. F. Swellie ... 393,527
Light. See Arc light.
Lock. See Door lock. Nut lock. Safe lock. Seal lock.
Loom for the manufacture of tufted pile fabrics, E. Buckley ... 393,458
Mail bag, C. C. Cook ... 393,360
Match blocks, machine for subdividing, Severic & Case ... 393,453
Measure, tape, O. L. Bard ... 393,603