(32) W. P. D. says: 1. What should the power of the telescope of an ordinary spectroscope be? A. That depends upon the class of work required. 2. What should be the length of the collimator tube? A. It should be the focal length of the lens for parallel light. 3. What should be the length of the slit? A. About $\frac{3}{10}$ of an inch. 4. Should the lens in the collimator tube be achromatic? A. It is not essential: but the lens must be free from spherical aberration.

(33) A. W. asks: Of what size and how far from an objective, consisting of 3 plano-convex lenses of $\frac{3}{18}$ inch focal length, should a diaphragm be? A. That can only be determined by trial. Some objectives do not require any diaphragm.

(34) B. C. says: 1. I wish to make a magic lantern. Can you tell me the best size of lenses to use, both condensing and objective, to throw a picture on a screen from 10 to 30 feet away? A. Use 4½ inch condensers with objective of 1¼ inch aperture and 6 inches focal length. 2. What change is made in the lenses to throw the picture farther away? A. Only a change of focus. The farther away, the larger the pieture. 3. Do the burner and the centers of the lenses require to be in line? A. Certainly.

(35) J. C. W. asks: What has become of the Keely motor? I hoped that there was something in it, as, allowing for large exaggerations, I did not think it possible that lawyers or men of standing in society could or would suffer their names to go forth to the world in connection with a humbug of such magnitude. What has become of it? A. Echo answers: What?

(36) E. asks: Is it possible by the use of prisms to so decompose or separate the prismatic rays of light as to enable the photographer to take pictures in colors? Chromos were first made by adding one color at a time. Why may not the rays of the camera be tinged by passing through media of prismatic colors superimposed on each other? Experiments in this direction will, I believe, yet solve the problem which has so long baffled photographers. A. The difficulty in photographing colors is not in the manner of lighting the subject, but in the fact that the photographic chemicals are insensitive to all colors except the blue and violet.

(37) M. J. M. says: I have a small stream of water carrying about 20 cubic feet per minute, in which I can obtain a head of not over 2 feet. Can I raise with such a head water enough for family use, with an hydraulic ram, to the hight of about 20 feet, say about 10 or 15 gallons per hour? A. This should be done without difficulty.

What is the rule for setting thimble skeins on axles? A. Perhaps some of our readers will give this correspondent the benefit of their experience.

(38) F. G. asks: 1. Is there any work in the English language that gives formulæ for grinding and arranging the lenses in modern compound microscopes? A. "The Microscope and its Revelations," by Dr. W. B. Carpenter. They are ground like all other lenses. 2. Can I get optical glass, both crown and flint, of uniform refractive power, whose index of refraction has already been ascertained with sufficient accuracy on which to calculate the curves of lenses without testing each piece separately? A. We do not think you can; but you can get glass of known specific gravity, which will enable you to form some idea of its quality.

(39) E. L. H. says: We differ on ventilation under the roof. One wants to ventilate directly through from the gable ends. I want ventilators in the ceiling, constructed so that they can be closed when desired, with an escape out through the steeple. Which will be the best? A. Your plan is the best; but it is also necessary to have openings near the floor as a part of a good system of ventilation. These should be arranged so as to prevent drafts as much as possible.

(40) E. L. H. asks: Are we to understand that you are opposed to arched ceilings for churches? We are building a church which is to be 50 x 76 feet x 35 feet, ceiling to be arched, having a spring of 9 feet, and paneled, commencing at the spring of the arch. The ribs forming the panel will be 24 inches deep. It will require some 5 or 6 of these ribs to give the desired finish, forming continuous panels from spring to spring of the arch. We desire your opinion. A. It is true that arched ceilings have proved to be subject to echoes more than those of other forms, but this seems to be governed somewhat by the hight of ceiling, low ceilings being apparently more subject to them than high ones. An arched ceiling is more objectionable still, on account of its tendency to thrust out the side walls and thus to cause a settlement. This has occurred in many cases where the buttresses were insufficient or entirely wanting, and where no tie rod or beam extended across the church at the eaves.

(41) H. C. D. asks: In making malleable cast iron it is melted in an air furnace. When it is put in, it is a gray cold blast charcoal iron. It remains there until it changes from gray to white. Does it contain more carbon when it is white than when it is gray? I think it does, for ir it remains in a little too long it becomes steel, which we can take to the blacksmith's fire, and draw and temper. A. The white contains the least carbon.

(42) G. L. P. Jr. asks: 1. Where can I get information as to making models and patterns for casting small steam cylinders and other articles? A. Consult our advertising columns. 2. What should be the length and breadth of ports, measuring on the cylinder face, of a cylinder, the bore of which is 2¼ inches and the stroke 4½ inches? A. Make your cylinder steam ports ¾ long and ⅛ inch wide, the exhaust port ¼ wide, and the bridges between the ports ⅛ wide. 3. What should be the size of the slide valve for same cylinder? A. Valve ⅞ wide, with an exhaust port barely ⅛ inch wide.

(43) R. C. asks: At how many revolutions per minute can we run a grindstone 6 feet in diameter with 8 inches face, with perfect safety? A. You may run it safely at 300 revolutions per minute.

(44) M. R. asks: 1. How old is the earth according to geology and astronomy? A. The age of the earth cannot be fixed, as its proved antiquity is so great that many cycles of ages, more or less, are of little consequence. 2. How long has it been since man made his first appearance on the earth? A. No one knows. The answer to the previous question applies to this one also.

If on a solid wheel, 4 feet in diameter, the point half the way (or 1 foot) from the center travels through only half the space in the same time that a point furthermost from the center does, is there not good reason to believe that there is a point in the center that does not move at all? A. There is in every rotating body, theoretically, a point of no rotatory motion. But it is a point, "without parts or any magnitude."

(45) H. H. A. says: I have a pump with 1¼ inch suction and 1 inch discharge pipe. At a very low speed it works well; but with full head of steam, it does not half fill the pump, and thumps badly. Is the suction pipe large enough? A. No. Make it 2 inches in diameter.

(46) W. F. S. asks: 1. Of what alloy shall I make a lead wheel on which to polish cut flint glass stoppers? A. Use old type metal. 2. How will I prepare the rottenstone to use with it? A. You had better purchase it already prepared. The back numbers you ask for are out of print.

(47) A. asks: Please inform me of the rule for determining the diameter of a wheel when number of teeth and pitch are given. A. Multiply the number of teeth by the pitch on the pitch line, and divide by 3·1416. The quotient is the diameter at the pitch line.

(48) J. E. H. asks: How is it that telegrams can be sent two ways over one wire at the same time? A. The instruments are so arranged that the current sent does not affect the receiving instrument of the station sending. This is effected in various ways. One of these consists in winding the magnets with double coils, the convolutions of which are put on oppositely; or the connections are so made that the result amounts to the same thing. One end of one coil is connected to the line wire: one end of the opposite coil, to the ground, through a resistance equivalent to that of the line; and the other ends of the coils are joined together. The junction is then connected to the transmitting apparatus. When a current is sent out it divides where the two coils meet, half passing through one coil to the line, the other half, through the opposite coil and resistance, to ground. As the half currents are oppositely directed in the two coils, the action of one neutralizes that of the other, and the iron cores remain unpolarized. The half current which goes to line passes on to the receiving instrument at the distant station, and, if the key at that point is open, goes through one coil of the instrument, thus producing a signal. There may also be a time, in simultaneous transmission, when the received half current passes through both coils of the home instrument. It will be observed, however, that, for such a case, the convolutions of the coils supplement each other; but at the same time, the current must pass through the extra resistance, so that while the number of convolutions is doubled, the current is reduced one half by this added resistance, and thus the effect remains as before.

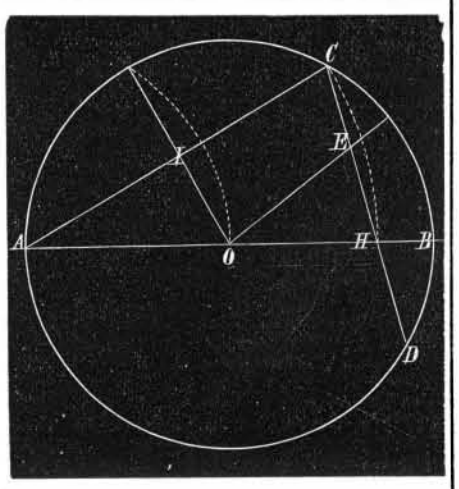
(49) A. I. says: Please give me a recipe for making the black composition that picture frame moldings are coated with. It is afterwards easily polished with a rubber to a jet black. A. Make your frames of plaster of Paris mixed with thin glue water. When dry, cover them with size and lampblack, and varnish with the following composition: Boil turpentine until it becomes black, and sprinkle on it 3 parts amber in fine powder to 1 turpentine. When the amber is melted, add some sarcocolla and more spirit of turpentine, and stir the whole. Strain the mixture, mix with ivory black, apply in a hot room to the plaster frames, and place in a heated oven. Two or three coats will be necessary.

(50) G. P. S. says: I have a zinc and carbon battery, the carbon plates of which are supported by copper connections. I find that the acid creeps up on these connections and corrodes them. What can I use to prevent the corrosion? A. The best plan is to deposit copper on the end of the carbon and then solder a wire to the deposit. First heat the end of the carbon and touch the part just beyond where the copper is to extend (about half an inch from the end) with a piece of paraffin, taking care it does not run up the part to be deposited on; should it do so, however, it may be driven off by a strong heat. When cold, cut a few scores in the surface to give a hold to the copper, and drill a hole through, in which fix firmly a copper wire projecting on each side. With a warm iron, spread a good film of paraffin from the line of intended coppering as far down the carbon as the part to be immersed in the liquid of the battery when working. Connect a wire to the carbon, by a screw clamp, and insert in a copper solution, arranging at first for a quick deposit. When a good deposit is made, drill a few holes right through copper and carbon, soak in water to remove any absorbed copper salt, and dry it thoroughly. Now tin the part to which the connecting wire is to be soldered and stand the carbon with its coppered end in melted paraffin till its upper part is well saturated. When the connection is soldered, a coating of paraffin may be spread with an iron over the copper and all parts of the carbon not intended to be acted on by the liquid.

(51) J. M. W. says: 1. It is universally accepted that a current of electricity on a wire is only complete when the metallic circuit is complete, and that a wire of 400 miles in length in reality is 400 miles of electricity. What becomes of the charge when the circuit is broken? Does it return to the battery and replace itself as before starting out upon its journey? This does not seem possible when we consider the amount of surface in both battery and wire. For instance, the surface of 400 miles of wire exceeds many times that of a battery consisting of 200 cells of gravity. What becomes of all this amount of force? A. The current circulates only when the circuit is complete; but it is not essential that the latter should be metallic. If the circuit is interrupted, when insulation is perfect, the conductor on each side of the break assumes a charge proportionate in magnitude to its surface, and its potential is equal to that of the battery.

(52) S. asks: Is there in existence a white cement for outside building purposes capable of standing the weather? A. Portland cement is probably the lightest: it is advertised in our columns. Ordinary hydraulic cement will make a light stucco by using white sand or a good lime paste with it. The lime paste may equal in volume the cement paste.

(53) H. C. N. says: I send you the following simple method of ascertaining the sides of some inscribed figures. Its simplicity will recommend it to your readers. Set off the radius, B C;



then from center, A, at distance, A C, cut off A H, equal to A C. Draw C D through H. The rest explains itself. A C is the side of an inscribed trigon, C D is the side of a square, D E the side of a hexagon, A I the side of a heptagon, O E the side of an octagon, D B the side of a dodecagon.

(54) J. M. W. says: 1. There are 9 or 10 wires feeding from two Callaud batteries; both take earth from same ground wire. If we adjust closely, we get a cross from either of the 9 wires. We did not have this trouble on same wire with an acid battery. Is this a feature of the Callaud, or is the defect at the point of junction with the ground wire, or is it in the ground wire wholly? A. No. The ground wire may be faulty; but it is more probable that defective insulation is the cause of the phenomenon. 2. Working a wire 400 miles in length, will it improve its working condition to use condensers at each terminus? A. No.

(55) J. M. W. asks: 1. Is the conductivity of a wire altered by expansion and contraction other than by tightening the connections at time of contracting? A. As the temperature rises, the conductivity becomes less. 2. In speaking of low and high resistance, is the term low used to designate resistance from 1 upwards, and high resistance the amount of interference it is capable of overcoming? A. Low and high resistance are relative terms; 1,000 ohms would be called exceedingly low resistance if it referred to the insulation of a mile of telegraph wire. 3. Common line relays are measured and marked like this: 75 ohms, 100 ohms, 130 ohms, etc. Is the one of 130 preferable to the others for intensity of attraction, and more suitable for general use? A. It would be more suitable for average telegraph lines; but these matters depend altogether upon the circuit in which the instruments are to be used. 4. I have a battery constructed as follows: The glass cell is 3 inches in diameter and about 4 or 5 inches high. In the bottom of this, I place a piece of cast iron, and suspend a disk of copper, both connected with insulated wire. I then fill up the cell with a strong solution of lye from wood and coal ashes. I get a pretty good current from it. Is it of any value? A. Very little.

(56) G. C. N. asks: Please tell me of some harmless substance by which light brown hair can be changed to a golden color. A. A dilute solution of chlor-nitric acid (*aqua regia*) applied as a hair wash will effect this. A similar preparation of peroxide of hydrogen may also be employed. But we cannot recommend the use of either. Any one who knows of a better recipe will please send it to box 773, New York city.

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

L. B. D.—The explosion was most probably caused by marsh gas or light carburetted hydrogen. This gas likewise forms the chief part of fire damp.—C. W. G.—It consists of oxide of iron, alumina, and silex. For anti-incrustators, see our advertising columns.—S. F. S.—It is yellow and blue clay. You might, with profit, see how it will stand heat.—D. T. G.—No. 1 consists mostly of silex, silicate of alumina, and carbonate of lime, nothing to render it more valuable than any common earth. No. 2 is a fine white clay, remarkable for its small percentage of combined water. Try its capabilities in the way of absorbing grease stains, drying up and disinfecting foul places, and similar uses. No. 3 is inspissated bitumen. You ought to be able to make use of it in manner proposed. No. 4 is rather doubtful. It contains a small percentage of oxide of iron. No. 5. The magnetite will all be swept out by a magnet, and the rest are quartz grains and hyacinths.—The spider from Jacksonville, Fla., has been handed to a distinguished entomologist for examination.—M. P. C.—It is celluloid. See p. 23, vol. 33.

W. A. F. asks: Will some one give a plan for straightening wire, from No. 16 to No. 8?—F. A. R. asks: How can I calculate the number of bushels of shelled corn contained in a crib of any certain size, the corn being on the cob?—G. M. Jr. asks: How can I make Cologne spirit?—J. W. B. asks: How can I put a fine black finish on gun work?—J. C. W. asks: How large a cube can be cut out of a ball 12 inches in diameter?—W. J. says: I am about to construct a flouring mill. Will some one tell me the size and length of reel, and number of cloth, which will make the most merchantable flour?—L. M. H. asks: Would lin wood do for building a boat 20 feet long?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Cheap Postage. By C. E. H,
On Superseding Steam. By H. C. D.
On the Post Office Department. By J.
On Explosives. By J. N. K.
On Frost and Waste Heat. By T. P.
On Creeping Rails. By L. D. W.
On a Blowpipe. By C. H. H.
On Bone Black. By F. L. B.
On Steam Domes. By T. H.
On the Years of the Planets. By J. H.
On Electric Organs. By T. G.

Also inquiries and answers from the following:

A. K.—A. C.—A. W.—K. S. D.—E. H. C.—G. C. P. Jr.—J. F. M.—B. F. G.—A. B. P.—L. C.—J. S.—J. H. R.—J. L.—J. S. T.—J. W. G.—A. L.—W. S. B.—D. R.—W. M. W.—M. McD.—H. F, G.—E. R. G.—I. J.—W. F. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells machinery for making flour sacks, and paper bag machines? Who sells meteorological instruments? Who makes large weight power machines? Who makes an artificial hand, which a disabled man can attach to the stump of his fore arm, so as to carry pails, etc.?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 7, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alarm, burglar, J. H. Thorp	174,594
Alarm, circuit closer, S. S. Applegate	174,461
Animal weaning bit, A. & A. J. Bartlet, Jr	174,406
Apples, etc., paring, J. L. Furey	174,513
Auger, earth, J. H. Lippincott	174,544
Bag holder, P. Cole	174,485
Bale band tightener, J. L. Sheppard	174,580
Barrel-painting machine, M. P. Carpenter	174,477
Base balls, manufacture of, W. Fletcher	174,511
Bedstead sofa, F. A. Hopper	174,530
Belt fastening, T. D. Brady	174,408
Blind stop, G. H. Nissen	174,558
Boat knees, socket for, D. True	174,595
Boats, construction of, G. W. Schermerhorn	174,382
Boiler, steam wash, J. T. Brown	174,469
Boiler, water tube steam McKaig *et al.*	174,552
Bolting apparatus, J. Turner	174,392
Boot and shoe heel stiffener, G. W. Day	174,494
Boot jack, G. W. Phenix	174,433
Boots, stand for blacking, E. M. Sammis	174,579
Bottle mold, S. Garwood	174,514
Bottle stopper, G. Johnson	174,534
Bouquet holder, J. A. Hurdle	174,364
Bridge pier, S. Mills	174,554
Bridges, construction of, T. C. Fidler	174,510
Bridle bit, F. Crane	174,353
Bronzing machine, D. Heston	174,526
Brush binder, B. H. Parks	174,565
Buckets, protecting, J. Bousfield	174,347
Buckle, W. Doyle	174,498
Buckle, tug, Darr & Bowman	174,414
Buckle, trace, J. Thornton	174,593
Buggy seat fastener, O. S. Gorton	174,513
Bung hole spout, C. F. Wilson	174,397
Burner, gas, A. Barbarin	174,464
Cancelling device, H. McDougall	174,374
Car brake, W. L. Hofecker	174,421
Car brake, J. Homer	174,529
Car coupling, R. Rennick	174,440
Car draw bar, J. D. Rhodes	174,574
Car heater and ventilator, E. E. Hargreaves	174,523
Car merchandising, A. H. Burhans	174,409
Cars, street, J. Stephenson (r) 6,985,6,98 6,987,6,988,	6,989
Car truck, C. T. Jeffries	174,533
Car ventilation, G. W. Maynard	174,549
Cars, transferring goods to and from, W. H. Elliot	174,357
Carriage, child's, J. Walker	174,597
Carriage top, landau, H. Lines	174,372
Carriage top box loop, C. H. Davis (r)	6,974

Carriage spring fastener, F. Miller	174,428
Carriages, top for children's, G. E. Whitmore	174,601
Catamenial sack, F. A. Knabe	174,540
Chair seats, etc., material for, F. Hickman	174,527
Check, bank note, etc., J. B. Johnston	174,536
Chronograph, electro, A. H. Russell	174,444
Cigar machine, M. F. Grimm	174,361
Cigar perforator, E. L. Conkey	174,488
Cloth-measuring machine, J. S. Gold	174,517
Cloth-steaming machine, W. Hebdon (r)	6,981
Clothes dryer, J. J. Reed	174,439
Clothes dryer, H. Shirey	174,583
Clutch, friction, W. F. Holske	174,363
Cock, gage, W. Andrews	174,344
Coffee roaster, C. L. Hall	174,521
Compound, cleansing, M. N. Cross	174,355
Confectionery, slab for, J. B. Rivera	174,575
Cooler, fluid, G. Jr., and J. J. Murray	174,556
Cop tube, J. Essex	174,505
Cotton scraper, L. Ewing	174,507
Cracker machine, W. H. Palmer	174,564
Culinary vessel, F. Morandi	174,555
Cultivator, H. Packer	174,563
Cultivator, A. Rutledge	174,577
Curry comb, C. E. L. Holmes	174,528
Curtain fixture, J. W. Johnson	174,535
Curves, etc., cutting regular, F. A. Polsley	174,434
Desk, C. A. Atkinson	174,404
Desk, school, J. W. Childs	174,480
Digger, potato, J. H. Gedney	174,359
Door, grain, J. W. Merriman	174,427
Door spring, J. K. Gilfillan	174,516
Doubletree socket, W. F. Cochrane	174,351
Drawer pull, W. N. Weeden	174,599
Drills, tripod for rock, L. W. Coe	174,352
Duster, wool, J. E. Overacker	173,562
Elevator, C. B. Wheelock	174,452
Elevator and carrier, hay, M. C. Smith *et al*	174,446
Elevator and conveyor, J. A. McAnulty	174,550
Elevator, water, J. Chenoweth	174,479
Engine, rotary, W. Lyon	174 546
Engines, link for steam, G. Palm	174,431
Engine valve gear, H. Tesseyman	174,590
Eraser holder, etc., rubber, H. C. Benson	174,466
Feather renovator, N. P. Chaney	174,412
Feed cutter, T. J. and G. M. Clark	174,483
Fence barb former, wire, Pooler and Jones	174,435
Fence, wire, W. D. Hunt (r)	6,976
Ferrotype plate, etc., H. M. Hedden (r)	6,982
Fertilizer, G. J. Popplein	174,568
Foot rest, E. B. Lovett	174,426
Fruit, machine for stoning, B. A. Lillie	174,371
Fuel, composition for, F. Brown	174,348
Furnace, blast, Rawlings and Irelan	174,380
Furnace, puddling, Reynolds and Thomas	174,573
Furnace, rotary puddling, E. A. Jones *et al*	174,537
Gage for cutting bias, E. S. Coon	174,490
Game counter, H. Bryant	174,471
Gas making, F. H. Eichbaum	174,502
Gas apparatus, hydrocarbon, J. J. Carberry	174,474
Gas machine, T. G. Springer	174,586
Gas, making, G. Olney	174,559
Gaslieers, suspending, J. R. Shirley	174,582
Gate, H. A. Webber	174,598
Gate, automatic, J. L. Manlove	174,547
Gate, flood, R. H. C. Rhea	174,441
Glass, tempering, F. De La Bastie (r) 6,971, 6,972,	6,973
Grain binder, C. B. Withington	174,454
Grapnel, self-acting, J. B. Toselli	174,448
Gymnastic apparatus, H. C. Driggs	174,499
Hammer, bush, C. E. Ward	174,394
Hammer connection link, Curkendall *et al*	174,493
Harness, A. Grabner	174,418
Harness hame, J. Thornton	174,591
Harrow, land, M. S. Hill	174,362
Harvester guard finger, A. Burkholder	174,350
Hat body stretching machine, J. S. Taylor	174,389
Hatchway, self-operating, E. A. Handraham	174,522
Hay cutter, G. M. Clark	174,482
Heat regulator, automatic, O. Plummer	174,379
Hinge, spring, G. D. Carleton	174,476
Hoisting apparatus, N. Thomas	174,455
Hook, safety, J. Thornton	174,592
Hoops, cutting, H. Fowler	174,512
Hoops, cutting locks in, L. S. Hoyt	174,531
Horse power, H. Smith (r)	6,978
Horses and cattle, feed for, H. H. Beach	174,346
Horses, stopping, W. T. and J. B. Burton	174,472
Horseshoe nails, finishing, H. A. Wills	174,603
Ice machine pipe, T. L. Rankin	174,572
Injector, J. Fergus	174,509
Injector, E. B. Rynear	174,578
Ironing apparatus, Sternberger and Pfautz	174,589
Jewelry, imitation, C. Downs	174,497
Knife, pocket, G. H. Evans	174,417
Knitting machine, C. J. Appleton	174,345
Knitting machine, circular, W. H. Abel	174,401
Label for plug tobacco, Liggett and Myers	174,370
Labeling machine, F. Russell	174,576
Lamp, A. Brandes	174,468
Lamp extinguisher, J. L. Shillito	174,581
Lamp-lighting device, F. L. Camm	174,411
Lamp shade holder, H. W. Hayden	174,524
Lantern, T. B. Osbourne	174,561
Latch, knob, H. H. Elwell	175,504
Lathe chuck for ovals, M. T. Boult	174,467
Lathe gear-cutting attachment, C. Walter	174,596
Lightning rod, J. H. Weston	174,451
Lime and cement, manufacturing, A. Smith	174,387
Loom shuttle, G. C. Mills	174,376
Lubricator, Bruce and Pool	174,470
Lubricator, E. Faull	174,508
Lubricator, T. Holland (r)	6,975
Mains, tapping, A. Letzkus	174,542, 174,543
Mangle, J. F. Baldwin	174,463
Measure, registering yard, J. Connor	174,487
Mechanical movement, M. H. Allen	174,460
Metal plates, etc., ornamenting, B. G. George (r)	6,980
Mitten, knit, W. H. Abel	174,402
Molder's flask, E. Joselyn	174,538
Molds and cores, material for, W. P. Darling	174,356
Mosquito bars, adjusting, I. A. Abbot	174,400
Mosquito net frame, J. B. Platt	174,567
Mucilage holder, W. J. Shilling	174,383
Music portfolio, A. F. Munson	174,377
Nut lock, W. Onions	174,560
Oil cup for journals, A. R. Yost	174,611
Oils, grading lubricating, H. B. Everest	174,506
Painting machine, barrel, M. P. Carpenter	174,477
Paper box, F. Kuehne	174,541
Paper-drying machine, A. W. Keeny	174,369
Paper, moth-proof, J. M. Cobb	174,484
Pavement, stone, Dean & Higdon	174,495
Photographic plate, H. M. Hedden	174,595
Pipes or tubes, bending, R. Wright	174,608
Pistol, spring air, H. M. Quackenbush (r)	5,977
Planisphere, P. Kuhnel	174,424
Plow, A. W. Johnson	174,367
Plow, B. S. Kearney	174,539
Plow, E. B. Knight	174,423
Plow brace die, C. H. Thompson	174,456
Plow, gang, E. C. Eaton	174,416
Plow point, W. H. Trissler	174,449
Plow, wheel, S. T. Adams	174,343
Plow, wheel, L. Cahill	174,473
Power brake, automatic, J. T. Wheeler	174,600
Press mat, oil, Perkins & Baker	174,432
Printing press, rotary, F. Meisel	174,553
Printing railway tickets, H. Messer	174,375
Propeller, vibrating, L. Gugler	174,419
Pump and engine, rotary, W. P. Maxson	174,373
Pump barrels to bases, attaching, G. D. Carleton	174,475
Pump, steam jet, H. P. Tenant	174,390
Punch, tubular cutting, J. A. Smart	174,386
Quilting frame, J. H. Sheets	174,445
Railway frog, E. H. Johnson	174,368
Railways, etc., subway for, M. A. Shepard	174,384
Railways, safety, J. B. Prohias	174,437
Range, T. J. March	174,548
Rectifying cylinder, liquor, S. B. Hulbert	174,532
Rein holder, I. W. Little	174,545
Rings, embossing, J. Jennings	174,422
Ropeway griper, W. Eppelsheimer	174,358
Running gear, A. B. Wroth	174,610
Saddle, riding, W. B. Crosby	174,492
Sails, reefing fore and aft, S. C. Loud	174,425
Sash fastener, W. G. Cook	174,489
Sash fastener, J. J. Dinnan	174,415
Sash fastener, L. J. Earll	174,501
Sawmill, circular, Elliott & McCool	174,503
Saw, scroll, E. C. Waterman	174,395
Saw set, S. Smith	174,585
Separator, grain, O. K. Wood	174,606
Sewing machine bobbin winder, C. L. Noe	174,429
Sheet metal ring, A. Taplin	174,388
Shingle edging machine, T. Neys	174,557
Shingle machine, M. Stewart	174,447
Shirt, Wolf & Jackson	174,605
Silk, etc., balance for testing, I. & G. Dimock	174,496
Soap mold, J. L. Jackson	174,365
Spigot and pump, vent, W. C. North	174,378
Spinning mule, J. S. Brown	174,349
Spoke shave, A. A Wood	174,399
Stairs, elevator, and shaft, S. Gray	174,519
Starching machine, L. Sternberger	174,587
Stereoscope, Paglinghi & Ardito	174,457
Stove, cooking, E. Bussey (r)	6,984
Stove drum, Wanderer & Gilg	174,393
Stove, base-burning, Carter & Dwyer (r)	6,979
Stove, vapor-burning, Jeffery & Rosengren	174,366
Surcingle, L. C. Chase	174,478
Suspender fastening, C. P. Clark	174,481
Suspenders, A. Adamson	174,459
Table and writing desk, D. J. Stein	174,588
Table, folding, G. B. Creary	174,491
Table, ironing, J. V. Six	174,385
Tailor's drafting apparatus, P. Roudel	174,443
Tank filler, automatic, A. Haerle	174,420
Teapot handle, J. A. Graff	174,520
Telegraphy, A. G. Bell	174,465
Tether, S. L. Boyles	174,407
Thill coupling, W. H. Cornell	174,413
Thrashing machines, spike for, C. Wilde	174,453
Throat and lungs, medicine for, E. Rohrer	174,442
Time and distance recorder, C. W. Simond	174,584
Tobacco, label for plug, Liggett & Myers	174,370
Toy, mechanical, W. Gifford	174,515
Toy money box, J. D. Butler	174,410
Toy money box, H. W. Prouty	174,569
Trap, animal, Barnett & Carpenter	174,405
Truss, P. Werum	174,450
Tubing, bending, R. Wright	174,607, 174,609
Umbrella, J. P. Onderdonk	174,430
Valve and gear, piston, J. Whitney	174,602
Valve, globe, D. McKenzie, Jr	174,551
Valve, steam, E. Purvis	174,570
Valves, thermostat, for controlling, H. R. Randall	174,571
Vehicle seat fastening, J. H. Adams	174,458
Vehicle wheel, G. Leverich (r)	6,983
Vehicle wheels, fender for, E. P. Roche	174,381
Vise, J. Wight	174,398
Wagon, dumping, W. S. & W. P. Babcock	174,462
Wagon end gate, S. F. & E. K Adair	174,403
Wagon end gate, W. H. Thomas	174,391
Washing machine, J. J. Quinn	174,438
Washing machine, S. Williams	174,604
Water closet, E Pearson	174,566
Water, supplying, M. G. White	174,396
Water wheel, N. M. Prince	174,436
Wheat, steaming, E. H. & C. L. Gratiot	174,360
Wool, removing burrs, etc., from, S. S. Eastwood	174,500
Wrench, R. Collingsworth	174,486
Wrench, pipe, I. Cressey	174,354

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9,120.—PAPER CLIPS.—O. F. Fogelstrand, Kensington, Ct.

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9,124, 9,125.—INKSTANDS.—H. J. Müller, N. Y. city.

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9,127.—PERFORATED PAPER.—G. M. Jacocks *et al.*, New York city.

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9,129.—BADGE.—A. J. Dallas, U. S. Army.

9,130.—MEDAL.—R. J. Delany, Philadelphia, Pa.

9,131.—PERFORATED PAPER.—G. M. Jacocks *et al.*, New York city.

9,132.—LAMP STANDS.—F. R. Seidensticker, West Meriden, Conn.

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