

(32) W. P. D. says: 1. What should the power of the telescope of an ordinary spectroscopic 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 $\frac{1}{10}$ 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 $\frac{3}{8}$ 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 $\frac{1}{4}$ inch condensers with objective of $1\frac{1}{4}$ 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 picture. 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 height 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 axes? 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 height 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 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 $2\frac{1}{4}$ inches and the stroke $4\frac{1}{2}$ inches? A. Make your cylinder steam ports $\frac{1}{4}$ long and $\frac{1}{8}$ inch wide, the exhaust port $\frac{1}{4}$ wide, and the bridges between the ports $\frac{1}{8}$ wide. 3. What should be the size of the slide valve for same cylinder? A. Valve $\frac{3}{8}$ wide, with an exhaust port barely $\frac{1}{8}$ 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 furthest 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 $1\frac{1}{2}$ 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.

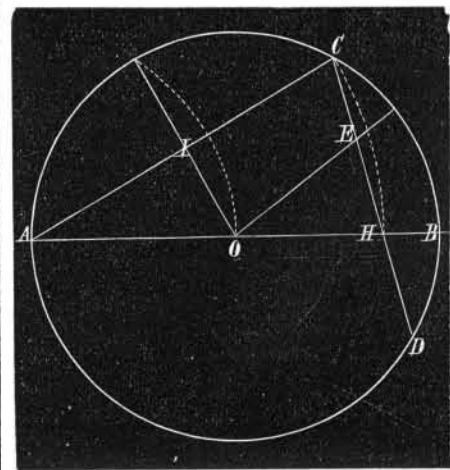
(50) G. P. S. says: I have a zinc and carbon battery, the carbon plates of which are supported by copper connections. I find that the acid creeps up on these connections and corrodes them. What can I use to prevent the corrosion? A. The best plan is to deposit copper on the end of the carbon and then 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 copping 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 re-

ality 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 silic. 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 silic, 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 pro-

posed. 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. J. 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. J. R.—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.—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 palls, 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 |
| Bottlestopper, G. Johnson..... | 174,534 |
| Bouquet holder, J. A. Hurdie..... | 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 |
| Cancellling 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) 6,985,6,986, 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..... | 174,572 |
| Carriage top, landau, H. Lines..... | 174,372 |
| Carriage top box loop, C. H. Davis (r)..... | 6,974 |