EXPANSION-JOINT.—R. E. VAIL, Mount Vernon, Ohio. Mr. Vail's invention refers to pipe-lines; and his object is the provision of an improved expansion-joint arranged to allow free expansion and contraction of the pipe-line without danger of leakage and to allow of readily coupling the adjacent ends of a broken line together.

GARDEN IMPLEMENT.—R. TWOHIG, Salina, Kan. In this patent the invention has particular application to means for securing pitchforks, hoes, rakes, and similar tools to their handles. The particular object is to provide means for securing the tools to the handle in such manner that there will be no possibility of the parts separating accidentally, thereby obviating the loss of time and liability to injury.

POCKET-BALL-BEARING DOOR AND HANGER THEREFOR.—J. K. THOMA, Cooperstown, N. Y. The purpose here is particularly to provide a top and bottom ball-bearing for sliding cased doors and a ball-bearing for the upper portion of hanging doors, such as barn or car doors, and to so confine the balls that their travel on the door will be limited, while their traveling engagement with either the overhead or the lower track will be unobstructed.

ORGAN-PEDAL.—E. M. HUGHES, Ashland, Ky. Definitely stated, this invention relates to pedal-keys for pipe-organs. The object is to provide a pedal or key which will work permanently and absolutely without noise. The pedal-keys for organs and other instruments work free from friction and obviate noise and lost motion common with similar pedals.

WHISK-BROOM.—H. L. HARRIS, New York, N. Y. The invention is an improvement in brooms, being in the nature of a rubbing attachment for use in removing spots and the like from garments. On the handle of the broom a pad of absorbent material is secured. The pad includes a core and wrapper, both made of felt, cloth, canvas, or like suitable fabric. In use the pad may be saturated with benzine or other cleaning materials. By combining the pad with the broom a convenient form of handle for the broom is provided.

UMBRELLA.—O. L. FOGLE, Columbus, Ohio. The object in this case is to furnish details of construction for the frame and stick, convenient to manipulate for folding or expansion of the umbrella, adapt the frame and stick for cheap manufacture, and enable the close folding of parts of the frame, so as to reduce the same, forming a short, compact package, which will be readily packed in a trunk, valise, or other receptacle.

AWNING-HOOK.—D. W. CARR, New York, N. Y. The invention relates to hooks especially designed for attachment to awnings, whereby to hang the awning and permit it to be taken down in a more convenient and expeditious manner than ordinarily and at the same time when attached to a support to insure its remaining so under ordinary conditions of weather until purposely released, the hooks, however, being also adapted for hanging curtains and garments on fixed hooks, eyes, rods, or bars.

PARCEL-FASTENER.—B. COHN, New York, N. Y. In this instance the object is to provide a new and improved parcel-fastener arranged to securely tie the wrapper of a box or like receptacle in position without the use of strings and the like and to give the parcel a fine and neat appearance. The device can be easily applied and cheaply manufactured.

HOLDER FOR MINERS' LAMP.—J. A. BROWN, Pocahontas, Va. In this patent the invention has for its object the provision of novel, simple, and reliable means for detachably securing a miner's lamp upon the cap worn by the miner, so that the lamp will remain in place until designedly removed, in spite of any accidental displacement therefrom.

COMBINED BODY-BRACE AND TRUSS.—S. R. SHEPARD, Louisville, Ky. One of the principal objects of the invention is to provide means adapted to be readily applied to the body for strengthening and supporting the back and spine and also the chest and shoulders, as well as to provide means whereby the abdominal region may be held in position with comfort and ease. The device is simple, and not likely to get out of order. It will not interfere with the free action of joints, muscles, or any other part of the body, and overcomes all tendencies toward abnormal stooping or bending.

PROCESS OF HARVESTING AND CURING TOBACCO.—J. B. UNDERWOOD, Fayetteville, N. C. This invention has for its object a quick method of curing and preparing tobacco for manufacturing and of improving the color and stem of the leaf. It is put in operation by the use of a V-shaped knife attached to a pistol-grip handle. The blade severs the leaf portion from the stem, leaving it attached to the stalk while the leaf is cured or dried out and freed from the stem at a much lower temperature and in shorter time, with more perfect color and without danger of sap coloring after curing. Expensive stemming is done away with and the taste and value of the product improved.

FOLDABLE PAPER BOX.—M. HIRSCH, Newark, N. J. The present invention relates to improvements in paper boxes; and the object of the inventor is to provide an improved box, the blank of which is cut from a single piece of paper stock and is adapted for assemblage into a complete article without the use of mucilaginous material.

COMBINED BUTTON AND TIE-HOLDER.—E. STEMPEL, Buffalo, N. Y. The object of this invention, relating to garment fasteners, is to provide an improved combination button and tie-holder arranged to securely hold a scarf, necktie, or other similar neckwear in place to prevent sidewise movement or creeping of the neckwear and to give a dressy appearance to the wearer.

### Designs.

DESIGN FOR A GLOVE.—F. SCHMIDT, New York, N. Y. The ornamental design in this glove consists of two bands of herring-bone of triple stitching on the back of the glove not quite parallel and coming together to a V-shaped point at the bottom. Between the two outer bands, equidistant a middle band is stitched. It makes no connection with the other bands. The design is open at the top.

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

## Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

**MUNN & CO.**



**Inquiry No. 4970.** For manufacturers of bordered cloth and materials for making handkerchiefs, also machinery for making elastic web for garters.



**Inquiry No. 4971.**—For makers of cold storage for family and individual use.



**Inquiry No. 4972.**—For a self-winding machine.



**Inquiry No. 4973.**—For a complete apparatus for manufacturing concentrated acid.



**Inquiry No. 4974.**—For makers of paint, such as used on steamboats, smokestacks, etc.



**Inquiry No. 4975.**—For makers of springs, such as used on small weighing scales.



**Inquiry No. 4976.**—For manufacturers of machines for punching teeth in hacksaws.



**Inquiry No. 4977.**—For a machine for extracting fiber from sisal or hennequen plants.



**Inquiry No. 4978.**—For makers of castings for a 4-cycle engine.



**Inquiry No. 4979.**—For the makers of the "Swartz" burner, or one to give a high candle power in a small space.



**Inquiry No. 4980.**—For machinery for extracting fiber from maguey plants.



**Inquiry No. 4981.**—For machinery for making oil of peppermint.



**Inquiry No. 4982.**—For a successful stump puller.



**Inquiry No. 4983.**—For the makers of the "Star" paper weight.



**Inquiry No. 4984.**—For hard rubber, glass or porcelain jars for battery use; to be rectangular in shape of special dimensions.



**Inquiry No. 4985.**—For makers of pyrometers indicating by colors.



**Inquiry No. 4986.**—For makers of machines for making pressed, blown and plate glass.



**Inquiry No. 4987.**—For a machine for grinding pea flour and a soap mold or presser.

**Inquiry No. 4988.**—For makers of paper board 4 feet wide and from 8 to 14 feet long.

**Inquiry No. 4989.**—For firms handling the button and shell mountings.

**Inquiry No. 4990.**—For machinery for making celluloid or horn combs.

**Inquiry No. 4991.**—For a pneumatic saw lately invented in the Northwest, wanted, address of patentee or manufacturer,

**Inquiry No. 4992.**—For makers of entire machinery used in making sulphur matches, including splitting and preparing of stock.

## Notes and Queries.

HINTS TO CORRESPONDENTS.

**Names and Address** must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
**Buyers** wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.
**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.
**Books** referred to promptly supplied on receipt of price.
**Minerals** sent for examination should be distinctly marked or labeled.

(9271) W. C. R. asks: Will you please tell me in your query column whether the following problem can be solved by plane geometry, and if so, how? Through the middle point (O, Fig. 2) of a chord draw two chords A D and B C. Connect A C and B D. Prove O R = O S. A. The problem may be solved as follows:

In Fig. 1, A D and B C any two chords cutting in O. M N any secant cutting A C in R, B C in P, A D in Q, and B D in S. ∠C = ∠D. △ C R G similar △ S H D, △ R G P similar △ O P L, △ Q H S similar △ O L Q.

$$\frac{CR}{Z} = \frac{SD}{X} \qquad \frac{RP}{Z} = \frac{OP}{Y} \qquad \frac{QS}{X} = \frac{QO}{Y}$$

Eliminate X, Y, Z from these equations:

$$CR \,.\, QS \,.\, OP = SD \,.\, QO \,.\, RP.$$

Similarly, $RQ \,.\, SB \,.\, OP = AR \,.\, PS \,.\, OQ.$

Divide $$\frac{CR \,.\, AR}{SD \,.\, SB} = \frac{RQ \,.\, RP}{PS \,.\, SQ}$$

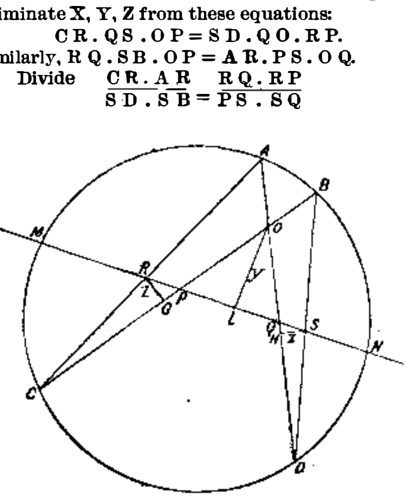

Fig. 1.

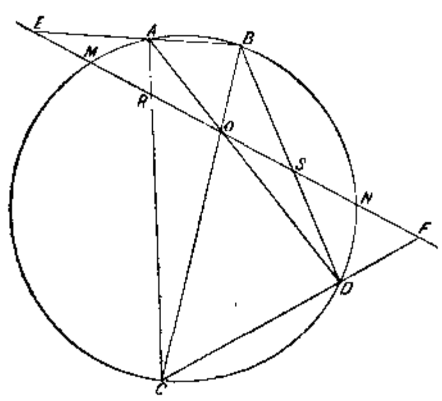

Fig. 2.

$CR \,.\, AR = MR \,.\, RN$ } products of segments of
$SD \,.\, SB = MS \,.\, SN$ } chords of a circle.

Substitute:

a) $$\frac{MR \,.\, RN}{MS \,.\, SN} = \frac{RP \,.\, RQ}{PS \,.\, SQ}$$

Fig. 2 is a special case of Fig. 1.

M N is bisected by O. P and Q vanish in O.

R P = R Q = R O, S P = S Q = S O, M O = N O, to prove R O = O S.

Equation a) becomes

$$\frac{MR \,.\, RN}{MS \,.\, SN} = \frac{RO^2}{SO^2} = \frac{(MO - RO)\,(NO + RO)}{(MO + SO)\,(NO - SO)} = \frac{(MO - RO)\,(MO + RO)}{(MO + SO)\,(MO - SO)}$$

$$\frac{MO^2 - RO^2}{RO^2} \qquad \frac{MO^2 - SO^2}{SO^2}$$

By composition

$$\frac{MO^2}{RO^2} = \frac{MO^2}{SO^2}$$

$$RO^2 = SO^2$$

$$RO = SO$$

Q. E. D.

Similarly E M = F N.

Solution by L. Leland Locke, Instructor in Mathematics, Adelphi College, Brooklyn, N. Y.

Since the above solution was completed, we notice a number of other solutions, different from the one given above, in Amer. Math. Monthly, January, 1901.

(9272) E. E. B. asks: I wish to purchase the cheapest and most efficient opaque attachment for the lantern. Refer to some dealer. Is it possible to use the film of the kodak for projection in the lantern without transferring it to glass? In other words to use the negative film in the lantern. Is there any preparation with which wood-cuts, half-tones, etc., may be treated and projected on the screen? That is, make a paper sufficiently transparent for projection purposes. Where can I purchase an attachment to throw soap-bubble films, etc., on the screen? I wish to project the vibrations of the human voice. A traveling lecturer partly told me of an experiment to show what he called the formation of the clouds and cyclones, etc. As near as he could remember they used sulphuric acid, and potasium bichromate, iron filings, and two other things that he could not remember. From this indefinite statement can you suggest the nature of this experiment or refer me to some work where I can find it described? As near as I could gather from his description it was to be projected with a stereopticon. A. The best and cheapest way to get a microscopic and vertical attachment for a stereopticon is to have the people who made the stereopticon furnish you with it. Makers usually have a complete outfit for their instruments. To get one made at a distance would result in a misfit, to a certainty. Failing in getting one from the makers you can have the attachments made by a machinist in your neighborhood, and fitted to the instrument. You can obtain good cuts of these instruments from the books on projection: Wright's "Light," price $2.00; Wright's "Optical Projection," price $2.25; Dolbear's "Art of Projection," price $2.00; Mayer's "Light," price $1.50. All these are excellent and you can profitably get them all. They contain nearly all that one requires to learn to do good work with the lantern and descriptions of all the best experiments. These, with G. M. Hopkins's work, will equip you for service. Many optical illusions are described in "Experimental Science," which you have. "Magic," by A. A. Hopkins, contains many tricks which are of the nature of optical illusions; price $2.50. No opaque attachment for the lantern is on the market so far as we know. Any mechanic can make one from the description in Dolbear's "Art of Projection," or from Hopkins's "Experimental Science," Vol. II, page 249; it presents no difficulty. Kodak films are not adapted for optical projection. A positive on glass should be made. For this, full directions are given in Hopkins's "Experimental Science," Vol. I., page 319. Special lantern slide plates can be bought for making them. Pictures from books cannot be made transparent enough to project in a lantern. They should be copied by photography, first making a negative and then a positive on glass as with any other subject. The method of projecting soap films is shown by a cut in Wright's "Optical Projection," page 326. The only apparatus required is a ring of wire 2 to 4 inches in diameter and a soap-bubble mixture which is described in all the books we have mentioned. The method of projecting clouds on the screen by chemical action is given in Dolbear's "Art of Projection." It is done by unequal chemical action forming absorbent layers in the cell.

(9273) J. P. R. says: In order to settle an argument would you please answer the following question in your "Notes and Queries" column: Is it safe to burn coke under a boiler, particularly an upright? A. Where the grates are properly arranged, coke makes the most admirable boiler fuel.

(9274) E. S. P. says: Please reply in "Notes and Queries": 1. Is the Texas boll weevil a flying beetle at any stage of its development? A. The cotton-boll weevil exists in four stages, namely, egg, larva, pupa, and adult. In the adult stage the insect has wings and is capable of flying to some extent. 2. If not, why cannot it be reduced by substituting upon infected fields other crops than cotton, thus depriving it of food and breeding place, or by letting the ground lie fallow? A. In view of the fact noted above that the weevil can fly, it is impossible to eradicate it by allowing land to lie fallow. Nevertheless, the powers of flight of the insect are so limited that many Texas cotton planters find it of great advantage to rotate their cotton with other crops. 3. If it is winged, why has it not been spread by winds, etc., more rapidly? Does it go from field to field? A. As a matter of fact, the weevil is spread to a considerable extent by the wind. The new territory invaded each year, under normal conditions, is about sixty miles. There is no doubt, however, that exceptional conditions, like the storms preceding the Galveston cyclone of September 8, 1900, have caused a great deal more than this normal spread. 4. If it simply crawls, does it gain access to the boll from the ground by climbing the stalk, and can it pass from one plant to another on their branches? A. The insect reaches the fruit of the plant, either boll or square, almost altogether by flying from one plant to another. 5. Will it attack in preference plants at some certain stage of growth, thus avoiding adjacent plants, either older or younger in growth? A. As during the growing season the cotton plant has all stages of the fruit upon it, it cannot be said that the weevil has any preference as far as the stages of the growth of the plant are concerned. 6. At what stage of growth is the plant most attractive? A. This question is partially answered under No. 5. There is no preference of the weevil for any particular stage of the plant, but there is a preference for the stage of development of the fruit. They prefer the forms or squares (immature bolls), and will always work upon them to the exclusion of the bolls as long as the supply is sufficient.—F. H. Chittenden, Acting Entomologist, U. S. Department of Agriculture, Washington, D. C.

(9275) G. B. writes: In an encyclopedia I find the statement that red, green, and blue are primary colors, and that they cannot be resolved into other colors nor produced by combining other colors. In discussing the subject a little further on, you state green is produced by combining yellow and blue, which is a contradiction of your first statement. I therefore take it that green can be resolved into yellow and blue; hence why do you say the primary colors cannot be resolved into others? A. We are not able to see the contradiction in the two statements that "red, green, and blue are primary colors" and that "green is produced by combining yellow and blue." Both are facts. Red, green, and blue are taken as primary color sensations by most modern writers, in accordance with the theory of the late Prof. Helmholtz, who was first in authority upon physiological optics. These colors satisfy most tests of a good working theory in this subject. There seems to be no better theory before the scientific world for acceptance. Until a better appears, it is not probable that this will be set aside. It is now found in almost every textbook of optics. An easy experiment may be performed with lights which illustrates the theory. Take three colored glasses or gelatines, a vermilion blue, an emerald green, and an ultramarine blue. Project these side by side on a screen, each by a separate lens, so arranged as to be movable; a circular form is perhaps more convenient for the experiment, and the projection may be so that the three circles are tangent to each other. Now move the lenses nearer together, so that the disks of colored light overlap. Do not have the disks themselves overlap, but the projections of the disks are to overlap. The red and the green light combine to form some shade of yellow, the green and blue form some shade intermediate between these shades, and the red and blue form some shade of purple. Where the three overlap you will have white, if the original colors were what are required by the proper spectrum tints. There are many other tints in sets of threes which will form white, but this set has been taken as on the whole the most satisfactory, and will for the present at least probably not be displaced. Now as to the statement that "green is produced by combining yellow and blue." Make one solution of potassium chromate, and another of copper sulphate, to which add ammonia till a rich deep blue color is obtained. Put these in vertical tanks or flat-sided bottles, and project as before. When the disks overlap, it is found that the combined disks give *white*. But if the light is allowed to pass through both solutions to the screens, the color on the screen is *green*. There is evidently something here to be studied. Test the two lights with a spectroscope or projecting prism. The yellow of the potassium chromate is found to transmit red, yellow, and green of the spectrum; the blue of the ammonio-sulphate of copper transmits green, blue and violet of the spectrum. Each absorbs what the other transmits with the exception of *green*, which is transmitted by both liquids. Green is the only portion of white light which can get through both liquids, and therefore a mixture of these colors always looks green. It is only in this sense that a combination of yellow and blue produces green, that is, by absorbing all other colors, green alone remains. If the yellow and blue lights are combined by mixture, not by absorption, *white* is produced. Both statements are facts. Each requires its proper interpretation.

(9276) S. H. asks: What is the relative increase of power as you near the focal end of a lever? To illustrate. Suppose the lever is 10 feet long and fulcrum is placed 24 inches from focal end, then to 18 inches and to 12 inches, what is the relative increase of power of the several positions as you approach the focal point? A. The mechanical efficiency of a lever is the ratio of the two arms, or distances from the fulcrum to the power and to the weight to be moved. If the lever is 10 feet long and the fulcrum is 2 feet from one end, the weight arm is 2 feet and the power arm is 8 feet. The weight is four times the power. If the weight arm is reduced to 1 foot, the power arm becomes 9 feet, and the weight will be nine times the power. In the same way the value of the lever in any case is determined. The ratio of the power to the weight is the same as that of the power arm to the weight arm.

(9277) S. S. W. asks: Will you inform me whether it is possible to raise the temperature of water any number of degrees by agitating it in a cylinder revolving at a rapid rate, if there are any impediments within the cylinder to break the water? If so, how high a temperature could be reached, and is it better to revolve the cylinder or a rod through the center to which the breaks are attached? A. It is not only possible to raise the temperature of water by agitating it, but this always occurs. The water at the foot of a fall is warmer than at the top, as has been proved at Niagara Falls. When the agitation takes place in a cylinder properly prepared for measurements, the amount of heat required to raise 1 pound one degree can be determined, and it is by this method that the work was done by Joule, upon which all steam engines are constructed. The heat unit is the quantity of heat required to raise one unit weight of water one degree, a unit in constant use in engineering. One pound of coal will produce on the average 14,000 to 15,000 heat units.

(9278) L. F. H. says: What is the method of piping now employed in the two-cycle engines in order to exhaust them under water? A. The action is somewhat similar to that which takes place in the steam engine. Exhausting a steam engine under water is a very bad plan to follow, not counterbalanced by any advantages. In striking water the steam is condensed and a vacuum is formed, the water immediately fills the exhaust pipe, and if the pipe is short, the cylinder also, unless there is a check valve in the exhaust pipe to prevent the water from flowing back. Moreover, there is a back pressure on the piston equal to the atmospheric pressure on the area of the exhaust pipe, which may or may not be 10 per cent of the power of the engine, according to the boiler pressure used. The method of piping depends upon the conditions present.

(9279) E. A. A. asks: 1. Is the energy in form of light in an inclosed furnace or under a steam boiler wasted? If not, how does it utilize itself? A. The light given out by burning coal is the same thing as its heat energy. Light and heat are the same thing, so far as energy is concerned. Both are classed as radiant energy in all the latest books of physics. The light is but an incident of an eye. If there were no eye the light would not appear. 2. How are the oil holes in the Morse twist drill made? A. We have no knowledge of the special process used in making the oil tubes in the twist drill you mention. You can address the inquiry to the company making the drill and they will doubtless give you the information. 3. How is the best magnet steel prepared and what hardness should it have to take and maintain the strongest magnetizing? A. Magnets are made of any high-grade steel. Jessup's and Stubbs' are very good. The ends of the magnet are glass-hardened, the rest remains soft. 4. Why does the resistance in an incandescent lamp filament increase with the age of it and why does the efficiency fall at the same time? A. The resistance of an incandescent lamp filament increases with use because the filament becomes smaller. The carbon is gradually driven off and flies against the bulb, making it black. As the resistance increases the current decreases, and if the lamp gets less current it cannot give as much light, since it is not heated so hot as at first.

(9280) G. W. B. says: 1. At what temperature will frost collect on glass if no moisture is in the air? A. Frost cannot collect on the windows when there is no moisture in the air at any temperature. Frost is the moisture of the air changed to ice. 2. At what temperature will it collect when there is a quantity of moisture in the air, such as is ordinarily? A. Water freezes at 32 deg. Fahr. and frost forms at the same temperature. 3. If temperature of a room is above freezing will frost collect on the windows? If so, at what temperature must the surrounding air be in order to keep glass warm enough to keep off frost and melt snow lighting on window? The idea is to keep the window transparent enough to clearly see through it. A. Frost may collect on windows when the air of the room is above freezing, since the glass is in contact with the outer air and is colder than the air in the room. The glass must be permanently above freezing to keep frost off and melt snow striking the windows. 4. What is the voltage and amperage of the ordinary circuit of lamps in a trolley car? A. If a voltage of 500 is used on a trolley car the lamps are usually of 100 volts each, and are placed in a series of five. 5. Is the current reduced by a transformer for this light circuit or taken directly from the main circuit? A. In the case above each lamp gets its requisite voltage and all are lighted directly from the trolley current without transformation. 6. Would the heat generated from an ordinary electric lamp as used in a trolley car be sufficient to melt a wax candle, if it were placed against the lamp? A. The heat from an ordinary incandescent lamp bulb is sufficient to melt wax candles and to set fire to paper or cloth left in contact with it for a long time. 7. Have you addresses of companies manufacturing condensers, as used with spark coils from ¼ inch up? A. You can obtain condensers from any dealer in electrical goods. Nearly every week we have advertisements of such in our columns. 8. Have you a SUPPLEMENT giving information on making condensers? A. SUPPLEMENT No. 1124, price 10 cents, gives the instructions necessary for making a condenser and a complete coil giving a spark of six inches. 9. Where can I buy or at what kind of place can I obtain tin-foil? A. Tin-foil can be bought from any electrical store.

(9281) A. N. says: What size wire must I use to magnetize a wire core for an induction coil, core being 7 inches by ⅞, No. 20? Annealed iron wire using 2 amperes, 20 volts? Also at 1½ amperes, 27 volts? Also at 1 ampere, 40 volts, or what would be the best current to use? I have a 40-watt dynamo which I am going to wind for it. What current would be best to wind it for, for use on coil? What is the carrying capacity of copper wire in armatures, that is, sizes from No. 16 B. & S. to No. 30 B. & S.? Also carrying capacity of wire in fields from No. 16 B. & S. to No. 30 B. & S.? Have you any SUPPLEMENT giving the above carrying capacities? If so, what number? Is hard granular carbon, such as used in telephone transmitters, good for coherers in wireless telegraphy? Should it be a rather fine powder or coarse? What is the best coherer to make and use for experimental purposes? Is there any that don't need decoherers? If so, what? How big a spark should 1½-pound s. c. c. B. & S. No. 35 copper wire give? How far will 1½-inch coil work a coherer? What size spark is used to signal across the Atlantic? What current is used in primary? Can more than one induction be connected in series? If two 1½-inch coils are connected in series, would it give 3 inches, or how should they be connected? A. Induction coils are made for certain length of spark, not for certain voltage and amperes of current. Wind the coil for spark, and then put on the current. The primary is always wound in two layers of coarse wire from end to end of the spool, which is mounted on the core, leaving the wires of the core projecting somewhat from the heads of the spool. You should get a book of directions for coil making, and follow its instructions. You will then be able to secure the sort of coil you desire. We recommend Norrie's Induction Coils, price $1. One and a half pounds of No. 35 cotton-covered magnet wire may give as a secondary of a coil a spark of ¾ to 1 inch long. As to your questions regarding wireless telegraphy, very little is known about the apparatus used for sending signals across the Atlantic Ocean. Coherers are made with silver or nickel filings in fine powder. You will find in our paper several forms of coherers. We can send you six papers on wireless telegraphy, or a dozen for that matter, which will give much assistance in the making of an apparatus. Two coils of a half-inch spark cannot be connected so as to give a spark of double the length.

(9282) H. F. asks: We have an electric light plant in our little city, direct current, 220 volts, quoting us a price of 10 cents per thousand watts. How much will this quotation cost us to run a 4-horsepower motor per 24 hours, as the city has installed this plant, and their engineer cannot give us the figures in horse power? A. An electrical horse power is 746 watts. Four horse power would be 2,984 watts per hour, and for 24 hours would be 71,616 watts. This at 10 cents per 1,000 watts would cost $7.16.

(9283) E. S. B. asks the following questions: If in any of the past issues the following questions are explained, I would only be too glad to get those SCIENTIFIC AMERICANS; but if the Editor cannot refer me to a back number, I will look for the answers in the columns of Notes and Queries. Explanation of alternating current, two-phase and three-phase current, and two-phase three-wire system. What is meant by inertia, the moment of inertia, and the inertia of a flywheel? How is the flywheel for an ordinary steam engine calculated? How is the flywheel of an air compressor belt-driven calculated? How is a flywheel calculated for an air compressor, the air compressor being connected tandem fashion to a steam cylinder, the air compressor in one case being single-acting, and in another case double-acting? How is the flywheel of an ammonia compressor calculated, having twin horizontal steam cylinders and twin vertical ammonia cylinders, the cranks being set at 90 deg. to each other, and the cylinders being double-acting and in another case single-acting? How is the balancing weight in the main driving wheel of a locomotive calculated? A. Your college library must surely contain books giving the information you desire. Any work on electricity will define an alternating current; any book on physics will define inertia. Any teacher of physics in the college can help you, and a technical college surely is provided with apparatus for illustrating all these points. An alternating current is one which changes the direction of flow at regular intervals. A current of 60 alternations would change 60 times per second, and would have 30 cycles or complete changes from positive to negative and back again. "Phase" expresses the relation of the e. m. f. to the current. In a single-phase current the pressure rises from zero to a maximum, falls to zero and to a negative value equal to the maximum positive value, and rises to zero again in each cycle. This current serves a two-wire circuit with a single pressure. A direct current dynamo would give this current if the commutator were replaced by rings. A two-phase machine has connection made with the armature coils, so that two single-phase currents are taken from it at the same time for two different currents, but the time of greatest pressure in one is the time of zero pressure in the other. The phases are 180 deg. apart. A three-phase circuit has theoretically three circuits of two wires each, and the pressure on any one is 120 deg. from those on either side of it. You will find the whole matter fully explained in Sheldon's "Alternating Current Machines," which we can send you for $2.50 by mail. In a two-phase system four wires are required for the use of both phases separately. Inertia is the tendency of a body at rest to remain at rest, and of a body in motion to remain in uniform motion in a straight line, unless compelled to change by some external force. The moment of inertia is the force necessary to give a body a unit angular velocity in one second. It is calculated for bodies of regular forms by formulas which you may find in books of higher mechanics. A good simple presentation of the subject may be found in Stewart and Lee's "Practical Physics," Vol. I., which we can send you for $2.25. The moment of inertia of a flywheel is that of a ring, very nearly, since the arms are usually very light as compared with the rim. The formula for this is $I \frac{R^2\ r^2}{2} \times M$, in which $M$ is the weight, $R$ the radius of the outside of the rim, and $r$ the radius of the inside of the rim. See SCIENTIFIC AMERICAN SUPPLEMENT No. 891 on centrifugal force as applied to revolving machinery, flywheels, etc., price 10 cents mailed. Thurston gives for automatic engines the formula $250{,}000 \frac{A\ S\ p}{R^2\ D^2} =$ the weight of flywheel, in which $A$ is the area of the piston in square inches, $S$ = stroke in feet, $p$ = mean steam pressure in pounds per square inch, $R$ = revolutions per minute, $D$ = outside diameter of wheel in feet. This formula is also applicable to belt-driven air compressors, and to the differential conditions of the steam and air cards of a steam-driven air compressor. In any form of compressors for air or ammonia, the compensating conditions of crank angle and opposite pressures must be considered and balanced in the complicated problem of flywheel weight and size. The balancing of the driving wheels of locomotives is somewhat complex, depending upon their reciprocating weights in the longitudinal and vertical direction. The subject of flywheel weights and sizes and counterbalancing locomotives is fully discussed in Kent's "Mechanical Engineer's Pocket Book," $5 by mail.

(9284) L. F. B. asks: Is there any reason why the —— and also the —— dry batteries, which are good, strong cells for automobile work, cannot be made more durable? The cell as it is now made is soldered. The joint of course starts small independent action, and that starts leaking and vaporization of the contents by the joint giving way. I have found this so almost invariably. It seems to me that a *zinc cell* could be made of seamless tubing, thus avoiding a soldered *joint* or *lap*. Better still, the whole cell could very easily be stamped or pressed out in one piece, as the common cartridge cell is pressed out. Is there any reason why this change in making would not be vastly superior, and also make the life of the battery considerably longer. The manufacturers would also save in cost of manufacture. A. The strong competition between the makers of cells has reduced the prices, but also unfortunately reduced the quality also. A good and durable dry cell is very much to be desired. Your suggestions seem to be of value.

(9285) W. S. says: How can I chemically treat Canton flannel and cotton draperies to make them non-inflammable? A. A composition, to be used for theatrical scenery (or the mounted but unpainted canvas to be used for this purpose), and also for woodwork, furniture, door and window frames, etc., is to be applied hot with a brush like ordinary paint. It is composed of boracic acid, 5 pounds; hydrochlorate of ammonia or sal-ammoniac, 15 pounds; potash feldspar, 5 pounds; gelatine, 1.5 pounds; size, 50 pounds; water, 100 pounds; to which is added a sufficient quantity of a suitable calcareous substance to give the composition sufficient body or consistency.

## NEW BOOKS, ETC.

THE TENEMENT HOUSE PROBLEM. Edited by Robert W. DeForest and Lawrence Veiller. New York: The Macmillan Company. 1903. Two volumes. 8vo. Pp. 470, 516. Price $6.

This book is published as a contribution to the cause of municipal reform. It embodies the result of the investigations made in connection with the work of the New York State Tenement House Commission, appointed by President Roosevelt when he was Governor of the State of New York in 1900. It also includes the Tenement House Law as amended, and an introduction bringing down the history of tenement reform in New York to 1903. The work is filled with illustrations showing typical conditions in American cities, and it must be said that the volumes are put down with a sense of sadness that such awful conditions can obtain in a civilized city. There is, however, the brighter side to the subject, as the second volume in particular shows what is being done to ameliorate the very terrible conditions which exist in New York city.

RADIANT ENERGY AND ITS ANALYSIS. Its Relation to Modern Astrophysics. By Edgar L. Larkin, Director of the Lowe Observatory, California. Los Angeles: Baumgardt Publishing Company. 1903. 12mo. Pp. 334.

The information presented in this book originally appeared in the form of a series of articles on radiant energy and its analysis in the San Francisco Examiner. Starting with an introductory chapter on radiant energy and on wave motion, Prof. Larkin passes to spectrum analysis and the spectroscope, showing just how important to the modern scientist the spectroscope has become. A chapter on Fraunhofer's work explains the discovery of Fraunhofer lines and their importance in the solar spectrum. Indeed, the most important chapters of this book are devoted to spectrum analysis, for very good reasons, too, in a popular book of this kind. Solar spots are discussed in a short chapter. Solar protuberances