with electrodes which wholly consist of metals whose illuminating-vapors form a linear spectrum of wholly or about wholly chemical rays which are specially adapted for the treatment of skin diseases, for telegraphic and photographic purposes, etc. To prevent the melting of these electrodes, they may be cooled in the usual way. Means are provided to permit the passage of the ultra-violet rays. The rays pass through the windows or lenses of the casing to the object to be treated.

SAFETY-BUCKLE.—A. ENGLERTH and H. SCHUETT, Chicago, Ill. The improvement of these inventors resides in a buckle adapted for attachment to a riding-saddle for the purpose of connecting a stirrup-strap thereto in a way to retain the strap on the saddle under normal conditions of use, but when the rider is thrown the pull of the strap in an abnormal direction operates to open the buckle and automatically release the stirrup and strap.

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.

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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.**

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For bridge erecting engines. J. S. Mundy, Newark, N. J.

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Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

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Send for a copy of "Dies and Die Making;" $1, post paid. J. L. Lucas, Bridgeport, Conn.

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Mechanics' Tools and materials. Net price catalogue Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 4724.—For manufacturers of machinery for canning factories.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4725.—For manufacturers of steel mills and spindles for cutting cut glass.

American inventions negotiated in Europe, Felix Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 4726.—For manufacturers of toys and novelties.

Let me sell your patent. I have buyers waiting. Charles A. Scott, Granite Building, Rochester, N. Y.

Inquiry No. 4727.—For makers of experimental supplies such as brass strips, aluminium wire, tin foil, etc.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 4728.—For dealers in miniature electric bulbs of two or three candle power.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

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Empire Brass Works, 106 E. 129th Street, New York. N. Y., have exceptional facilities for manufacuring any article requiring machine shop and plating room.

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Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

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Inquiry No. 4742.—For a second-hand clay filtering machine for use in factories.

Inquiry No. 4743.—For makers of brass and wrought steel teaspoons.

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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.

(9210) E. E. H. says: Can you give me any information in regard to vaporization of alcohol and kerosene? Or can you tell me of any book or publication in which I could get the information? A. In reply to your question regarding the vaporization of alcohol and kerosene, we would say that you will find a very complete statement about alcohol in the "Tables of the Properties of Saturated Steam and Other Vapors," by C. H. Peabody; price $1.00 postpaid. Kerosene is not a single chemical substance like alcohol, but is a mixture of a large number of different hydro-carbons which are vaporized at different temperatures and which obey different laws. It is therefore impossible to give for it information similar to that contained in the tables referred to above for alcohol.

(9211) L. A. I. says. Suppose you take a steel cylinder and completely fill it with a mixture of air and gas under pressure, say, 40 pounds per square inch, similar to the mixture in a cylinder of an ordinary gasoline engine just before ignition. Now suppose the mixture is exploded by an electric spark. What would be the temperature and pressure immediately after the explosion and what would be the pressure after the cylinder had cooled to the original temperature? Are indicator cards ever taken from cylinders of gasoline engines? How much is the average M. E. P. generally found in gasoline engines—that is, how many pounds per square inch? A. Replying to your inquiry we would say that it is impossible to accurately estimate the temperature in the cylinder of a gasoline engine after ignition without knowing the exact amount of gasoline consumed. One pound of gasoline, when completely burned, will generate about 20,000 British thermal units, and each B. T. U. will heat each pound of the products of combustion, if there is no heat lost by radiation, about four degrees. At atmospheric pressure, about thirteen cubic feet of air weighs one pound. From this you may be able to get some idea of the temperature which is possible when the gasoline is burned. Our judgment is that the temperature of the flame in the cylinder may vary from perhaps 1,500 or 1,600 deg. F., according to the mixture, to over 2,400 deg. The pressure is increased in the same ratio as the absolute temperature; after the temperature is lowered to the original temperature, the pressure would be slightly less than it was before combustion took place, because the hydrogen which forms a part of the gasoline would burn out some of the oxygen, forming steam which would condense. The carbon, the other constituent of the gasoline, burns the CO which occupies the same space as the oxygen consumed. Indicator cards are frequently taken on gasoline engines, but the M. E. P. varies very greatly. "Gas Engines," by D. Clerk, price $2.00, and "Gas and Petroleum Engines," by William Robinson, price $5.50, will give you a great deal of valuable information on this subject.

(9212) I. L. says: Thanking you for your answer to my previous questions, I beg to submit some more to you. Does an eel have two hearts, and, if so, how many times per minute does each beat? If not, is there any living organism having two or more hearts, and, if so, what is the respective number of beats per second of each? Has lightning any real width, and, if so, what is it? What is the apparent width? Does it have any shape, that is, the cross section of a stroke? What is the length of an average stroke? Of an extreme one? Of a short one? What is the actual mechanical power in lightning? That is, if we transformed the high pressure of an ordinary stroke of lightning down to a low pressure, raising, of course, the amperage as we decreased the voltage, grant that there is no loss of current in transforming, would the current that we got have any power to decompose water or run a motor to any appreciable extent? Is there such a thing as "ball lightning," and if so, what are the known facts concerning it? Has it, if a reality, been produced artificially; and, if so, how? Is the cause of thunder known? If so, what is it? If not, what is the most probable theory? What about "the air rushing into the vacuum" theory? What are the weak points in this theory? Has thunder been known to kill ducks or chickens in the shell? Does thunder curdle or sour milk, and, if so, why? What is the largest number of people ever carried in one day by the B. R. T. railway system? On what day were they carried? Do you consider the ——— ——— cycle the equal of any other motorcycle? Do you consider it the best? Do you consider the ——— automobile a reliable automobile for ordinary usage? If a perfect vacuum is a perfect non-conductor of electricity, why can't an induction coil be insulated by being "jacketed" in a vacuum tube? If silver is 100, what is the electrical conducting power of glass when heated? I have an induction coil wound with Nos. 14 and 36 wire. What amperage and voltage should I give it? It is a large coil, and I think it was made from plans in one of your SUPPLEMENTS. If you could tell me which SUPPLEMENT it was, I would like to get it. It gives ordinarily 1½-inch spark. Is radium a metal? What is the numerical radio-activity of radium, polonium, actinium, and uranium? What is a good book treating of Geissler tubes and of fluorescence? A. Your questions about lightning have no exact answers, as any can see. No two flashes are necessarily alike. The distance from the cloud to the earth, or rather the resistance between them, determines the intensity of the flash discharge, and so all the quantities you ask for. We know nothing at all about the actual mechanical power of lightning. We may surmise about it, but there is no basis in actual fact for the surmise. It has power enough to split trees, etc., which would require many horse power. Ball lightning is admitted by most to be a reality. Little else is known about it. Thunder is the concussion of the air as it closes up after the discharge has taken place. We do not know whether it has killed ducks or not. Milk is usually found sour the morning after a thunder storm. We cannot explain why. As it is impossible to produce a perfect vacuum, it is not clear how you would put an induction coil into a perfect vacuum. It is still more obscure how you could carry the wire into the vacuum to bring out the discharge of the coil. The specific resistance of glass at 20 deg. C. is given by Thompson as 91 followed by 18 ciphers, and at 200 deg. C. as 227 followed by 11 ciphers. The resistance for silver is 1.492 annealed, and 1.620 hard. You can change this to silver 100 in each case. You do not specify the kind of silver you have in mind, and we leave the calculation for the case in hand to yourself. The coil you have, giving an inch and a half spark, is described in the SUPPLEMENT, No. 160, which we furnish for 10 cents. As you desire to get the paper, you will find all needed instruction and information therein regarding the use of the coil. Radium is supposed to be a metal allied to uranium. The radio-activity of various degrees ranges from small powers up to several hundred thousand. Geissler tubes are not specifically treated in any separate book. Any good book on electricity gives enough regarding them. Try Thompson's "Elementary Lessons," which we send for $1.40 by mail. We have no information relating to eels. Answers to this and your other questions can be given for a fee of $10.

(9213) L. S. asks: I have eight carbon cylinder cells and use sal-ammoniac solution for lighting a few miniature lamps, but the lamps are only bright a few minutes. What formula could I use in the carbon cylinder cells so the lights should burn bright for about one-half hour at a time? A. We would advise that the sal-ammoniac battery is not adapted to lighting an electric lamp. If used constantly it soon falls off in current, as you have observed. A steady service will soon destroy the battery. The Edison-Lalande cell, using about twice as many as of the Leclanche, will give much better satisfaction.

(9214) G. A. V. B. says: Can you give me any information in regard to making brick from cement and sand or cement, sand, and lime? How will cost compare with burned clay brick, also are they as durable and desirable as common clay brick? How much sand and cement are required per 1,000, and proportion of same? How are cementine houses constructed, and are they more costly than lumber houses? I understand there are a great many in California. What are the best proportions for making cement for walls of houses? What kind of cement is generally used for all these different kinds of work—Portland or Rosendale? A. In reply to your inquiry regarding the making of brick from cement and sand, or from cement, sand, and lime, we would say that, as a rule, the cost of such brick will exceed the cost of burned clay brick. For some purposes, however, such bricks have been successfully used, especially for pavement purposes, where the wear is not too heavy. For sidewalk pavements, if properly made, cement and sand brick are very durable, and are preferable to common clay brick. They should be made of the best Portland cement, clean, sharp sand, and finely broken stone or some other hard and durable material. The best proportion of these ingredients will vary somewhat with the character of the cement, sand, and stone. A good average proportion, however, is one part of cement, three parts of sand, five parts of broken stone. If Rosendale cement is used, the mixture should be a trifle richer in cement, and the bricks will not be nearly so durable. They will, however, be less expensive. Cement houses are made by filling in the space between temporary planking, which is constructed so as to form a box, with concrete, the width of this box being equal to the desired thickness of the walls. After the concrete has set, the temporary woodwork is removed and placed higher up, so that more concrete may be filled in. Two or three feet is added to the walls in this way at a time until they are carried to the desired height. Both Rosendale and Portland cements are used for this purpose, but Portland cement is much more durable and decidedly preferable. The proportion for the concrete for such houses is substantially the same as that given above for paving brick. The cost of these houses usually exceeds that of ordinary frame houses. They are, however, more substantial.

(9215) C. D. J. writes: I have read with some interest query 9036, A. W., June 6; 9086, A. M. W., July 11, and 9184, S. R., September 26, regarding the purple coloration of glass. I suppose window glass is the only kind referred to, because it is the only kind I have ever seen the discoloration, or coloration as you might call it, in. I am a window-glass worker, and have been for twenty years, and have the tradition of several generations before, and faded or discolored glass has always been the bane of the window-glass industry. There is no known cause, and one known remedy—that of reannealing it. I can show you glass made ninety years ago in the Catskills, using wood fire to melt, and making the glass with sand, slaked lime, and potash made from ashes; one light of glass as clear as the day made, the other has the coloration. I can show you glass made in 1903 in Indiana, with natural gas; glass made with sand, carbonate of soda, sulphate of soda, and raw lime. One is faded, the other not, and this has always been the way in high altitudes, in low, in hot and cold. We have tried all kinds of experiments to overcome this; different kinds of fuel. Our mix we cannot change much. That is practically the same as it has been for years. We have dipped our glass in the different acids without any seeming difference; some will fade, and some will not. If the SCIENTIFIC AMERICAN or any of its correspondents could suggest something to overcome this, it would be a great boon.

(9216) F. H. asks: 1. Kindly let me know the operation of a Crookes tube. My understanding is that the platinum terminal is the anode and connected to the positive side of the generator and the concave aluminium terminal to the negative side. If the current travels as claimed from the positive to the negative, why does it leap from the aluminium to the platinum, which acts as a target? A. The platinum terminal is the anode of an X-ray tube. From the negative terminal or cathode the stream of particles proceeds which bombard the anode and produce the rays. We do not see that this is connected with the direction in which a current flows through a conductor. The streaming is from the cathode. The current may be in the opposite direction. However, the direction of a current is entirely conventional. We speak of it as from plus to minus. Who knows that it is so? It is as conventional as to shake hands with the right hand, or to call the north pole of a magnet plus. 2. Also the action of the auxiliary tube of a Crookes in connection with X-ray work to adjust the vacuum—how the vacuum is raised and lowered, as well as kept stationary; what connections are made to the auxiliary, when to raise and to lower the vacuum. A. The vacuum of an X-ray tube is lowered by heating the chemical in the auxiliary tube and driving some of it as a vapor into the larger tube. This is absorbed again, and the vacuum rises. Before the tube will work properly the vacuum must be lowered again. The connections are variously made for different tubes. The maker furnishes the proper directions with his tube.

(9217) Mrs. W. C., who inquires for names and addresses of bell founders, should give us full address, as we only answer queries of this nature by mail.

(9218) F. M. W. says: Lawrence, Mich., is a town of 800 population, and has voted lights and water-works. A proposition has been received of a cold process gasoline plant for gas lighting and heating. What do you think of its practicability and expense for this size town? What would be an average price for gas per 1,000 cubic feet in cities? As compared with electricity, what do you think the expense would be? A. The gasoline and air "vapor gas" is in general use in country houses and in villages. There is no objection to its use save the possibility of condensation of the vapor in the pipes in very cold weather, which is not serious with good management in laying out the pipe work. If the company is responsible, they may guarantee this. For heating purposes, coal is the cheaper and safer to manage. Illuminating gas costs in large cities about $1 per 1,000 cubic feet, and in small towns from $1.50 to $2 per 1,000 cubic feet. We advise that the gasoline system is practical and the cheapest for your town. Electrical lighting will be very expensive on a small scale.

(9219) B. K. D. asks: 1. Will you please tell me whether the induction on a