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some answerse require not a little reeearch, and gome anowers require not a little reesearch, and,
though we endeavor to reply to tald either by lette
or in this eepartment each must take his turn.



price.
Mil nerals sent for
marked or labelec.
(7542) J. D. asks: How many pounds of compression is required to the inch to make liquefied ualess it is at the same time cooled to at least $220^{\circ}$ Fah. below zero. When cooled to this temperature, a pressure of 585 pounds to the square inch is required to
liquefy it. In practice a pressure of from 2,000 to 2,500 pounde per square inch is employed.
(7543) Q. writes: 1. I have a battery composed of Your Edison-Lalande celle. What charge
should be used in the cells? What E. M. F. ebouid eact should be used in the cells ? What E. M. F. ebouid each
cell have? What internal resistance should each cell havep A. The Edlson-Lalande cell is charged with a 25 per cent solution of caustic potash in water, or one
pound of caustic potash to three pounds of water. The E. M. F. of these cells is about seven-tenthe of a volt. The interval resistance varies with the different form
from 0.02 ohm to 0.5 ohm . 2. What voltage should take to electrolyze, at a fairly rapid rate, water, hiydro chlonc acid, copper sulphate, sodium chloride, sodium suiphate? A. All these eubstances will be decomposed
at a fairly rapid rate with any voltage above 20 volts. 3 . Where should one be able to procare, in and sich diamerer, and suitable for use in home-made Bunsen cellise A. Zinc rods of this size must be made on special
order. Address any dealer in metals. We should adorder. Address any dealer in metals. We should ad
vise gon not to use a large rod of zinc in a Bunsen cell but either a plate bent into a cylinder or a Daniell's zinc For these address any dealer in electrical supplies in ou advertising columus. 4. Is there any relation between (a)
hardnees and density, (b) hardness and ductility, (c) density and ductility ? A. No relation is known between
(7544) C. T. P. asks : 1. Would good the simple electric motor described in Scientific merican Supplement, No. 641, than the Rusbian iro and havethem jointed at each end ? A. Any good soft Supplement. No. 641. Cast iron can be used, but the ynamo will then have only one- half the output whic it will have if wrought iron is used. 2. Please give the
voltage and amperage of 8 cells of plunging bichromate batteries. A. The working voltage of the blchromat cell averages about $1 \cdot 8$. Eight celle will then have about 14 volte. The current on short circuit is very large, but rope rapidly. No figures can be given for every casc ince so many factors enter into the problem: freshnee and strength of solution, distance between plates, con aitions of zince. Four amperes is perhaps a fair figure n an ordinary circul. 3. How large a storage batter and how to make one, and the difference in the cost $\alpha$ hem. A. You will need the same number of storag cells as of potassium bichromate cells. A charging batreater than of one alone. A form of storage cell is de cribed in Scientific American Supplement, No. 845 price 10 cente.
(7545) F. B. F. writes : 1. I have a mo or made from the drawinge and speclifications in the tipplemenc. No. dynamo. What iize wire and what quantits will it re what quantity and what atyle of armature will produce of dieas here. To convert the motor of Supplemerist,

| No. 641, into a dynamo is one thing, to build a dynamo |
| :--- |
| from the esketch inclosed is quite another thing. First, | to convert the motor, connect to some source of powe and run ut up to full speed. In case it does not generate current, disco:3nect the field circuit and excite the field

by a battery. Such small machines are quite likely not to be self-exciting. Second, it is uot well to attempt nuild a dynamo from your sketch. It is not well de
signed. The cores of feld magnete are $\% / 8$ by $13 / 8$ inches
, signed. The cores of feld magnete are $9 / 8$ by $1 \%$ inches,
haviug only $1 / 8$ quare inch area of crose eection. Quite wo small. The space left for a spool and wire is only $\$$ The pole pieces are much too heavy for the other parte, and the armature space too large. 2. How many, if any, 50 volt 16 candle power incandescent lampe will it light? What speed will it be required to run it 9 A. Yourex Such a machine will not light any 16 candle power 50 volt lamps $1 t$ might be $a$ dor power low voltage lamps. A dynamo which is only 10
niches by 5 inches by $21 / 2$ inches cannot furnish a heav current. You cannot produce a 14 candle power lam which can be lighted with one ampere at 14 volte. Thre and four volte per candle is about as well as any one ca do now. Our advice would be to find a plan fully de eloped for a dynamo which will do the amount of wor you need to have done. Y ou can light 8 to 10 lampe of 16 candle power with one horse power. 3. What size and field magnets to produce a current that will light 14 candle power 14 volt 1 ampere incandescent lamps, and
how many will it light 9 At what speed will it be necessary to run the dynamo ${ }^{\text {? }}$ A. There is a book giving
plans for several sizes of dynamo from ta horse powe plans for several sizes of dynamo from $1 / 8$ horse powe to a 20 iight machine by Ed.
send you for $\$ 2.50$ by mall.
(7546) J. E. D. writes: 1. Treating on the velocity of failing bodies, A very's "Physics," on
page 107 , example 53 , statement is made as follows : From an upper window drop simultaneously, from eac
 ground practically at the same time." A. The state ment quoted above is the theoretical statement usual
ound without qualification in elementary text books of phyics. For small, compact masses of heavy materia, uch as stone and common metal, failing not more tha very closely with that given by theory. 2. Will you indly give formula goyerning say a lead ball welghln en pounds, and a wooden ball of same size weighin ne pound, dropped from an altitude of 1.000 feet wher air pressure is fifteen pounds per square inch at ground Kindly dilate upon theory, for there is a diversity of pinion here. A. Wben two bodies of the same size but of different weight fall through the air, the air resis apply to a body at rest, against which the wind Since the same pressure is produced by a body movin against air at rest, as by the air moving with the same velocity against a body at rest. The formulas asked for
re those for wind pressure agalnst structures as give in works on cagineering. The surface pressed upon is falling body is the velocity at the middle of the time falling body is the descent. The mean resistance of the air ls that due othis velocity as per tables given in engineer's pocke books. This multiplied by surface pressed upon give otal resistance. The difference in air pressure for 1,000
eet is one half pound per square inch A fter all calcuations and allowances have been made, the calculate esult will probably differ widely from the result of ex bridge differs widely from the real pressure. Nor are here any experimental resulte to be had. There is no ir lice on the earth where a ball can be dropped in ope belng 300 meters. Balle dropped down the shafte
(7547) W. J. K. asks: 1. What kind o cad is used for storage battery plates, cast or rolled A. The plates of accumulatory ${ }^{\text {a }}$ are of cast lead. 2. I
litharge is used to coat the plates, how long will it tak the plates to "form" so that they can be used $\%$ A. Th ength of time depends on the esize of plate and streng 3. If the cell is left nncharged, how will it be affected A. The cell is rapidly destroyed. 4. If it is left charged how will it be affected? A. If a cell is left charged o ancharged for any length of time without using it, a hard insoluble sulphate of lead is formed which hinder the action, uses up active material, and tends to disinte-
grate the plate. 5. Does the liquid in the cell ever have be renewed $?$ A. The sulphuric acid is not used up ver action of the cell, but remains and losed cell is full charged? A. A cell is charged to $2 \cdot 5$ volte charge till gas is given off rapidly from the plates. 7. About how
many amperes will a cell give having five plates, each many amperes will a cell give having five plates,
inches by 1 inch 9 A. About six tenthe ampere
(7548) G. H. F. asks: Will the heate debcribed in Supplement No. 1112 work on alcernatin current ? A. Certainls. One sort of electric clirrent ma be transiormed into heal as well as another. The heat the current in amperes and to the resistance in ohms, of essed in letters, to $\mathbf{C}^{2}$ R.
(7549) J. R. C. writes: Please give mething of the construction of a repeating coil. Such on used in connecting a ground circuit with metallic telewhose two windinge are puter on together and are of equal length. One of the windings is $u$ ved to complete the metalic circuit, the otber to coanect between the sub scriber's withe and the ground, so ast to compling the metallic circuit. Variou orts and modifcation of this be found in Poole Telepbone Handbook, price $\$ 1.50$ hy mail.
(7550; C. O. H. writes: 1. I am about oo make a new armature of the drum type for motor 641.
as I think it will have double the effciency with the ame amount of wire. How many nrougbt. Iron rings west thlng to do is to buy armature disks punched for
the purpose with projections making grooves into which he colls are wound. These diske are about $\$ \frac{1}{2}$ inch Supplement No. 600, price 10 cents. With paper dieks alternating with the wrought iron dieks, the armature core should be a little longer than the width of the pole pieces. 2. If practical, I should like to get 110 volts
from it when run as a dynamo. Then what size wire hould I use and how many layers? A. For 110 volta, se No. 30 A. W. G. siugle covered wire on armature and the coils to eame size as in original form. 3. Sbould be wound in twelve or more sections \& A. Twelve is good number of sections for the armature.
(7551) T. E. says: 1. I intend to make storage battery of six cells, having a capacity of 100 ampere hours to each cell. They will be made on tbe hat could be used in cbarging them (without injury) A. Use 6 to 8 amperes per square foot of surface of pos Aive plates, reckoning bott. Bides in charging a storage andle power lamps \& hours would they run four 8 be amperes required for each lamp by 4 and divide the 00 ampere hours by this number. 3. Of how low volt ge can a 16 -candle power lamp be bad 9 A. Sisteencandle power lampe are usually made for 100 or for 50 volt circuite. With six cells you will not be able to use light of more than 10 volts, and to obtain 16 -candle mp is made to carry bo large a current. amp is made to carry so large a curren. 4. Does
dynamo and storage battery work well in a low temperacure, such as 20 degrees below zero? A. We know no reason why a dynamo should not work just as well at the attery will not freeze at 20 degrees below zero, and
(7552) W. M. P. asks: 1. How can change the current of a small magneto ( 10,000 ohme) as to get an even and smooth current as from batteries
A. By running it so fast that the impulses of the curent are as rapid as those from the battery, which, we hardly need to asy, cannot be done. 2. Would it strength ields separately ? A. Yes; by just the amount of current which the resistance and self-induction of the feld ases up. It is, however, cheaper to furnish this current
from the dynamo itself than to provide it from some eparate source, if the dynamo gives a direct current. he d snamo is alternating, it must be separately excited.
3. I have a small one-quarter horse power motor, but do not know how many volte it is wound for. The fields are composed of a large iron ring and there are four places for windings. In each place is wrapped two layers of No. 20 wire. The armature is composed of an iron ring, with eight parts, and is wrapped with No. 2 wire. There is an adaitional part to the fielde which fle inide the armature which looks like a two pole arma the windinge on thls motor so. How tould 1 chan volt current 9 4. I have the castings for a mmall dyna or motor fields, have place for but one winding, and his is $13 / 8$ by $11 / 6$. Wbat size wire should $I$ use to mak this a dynamo and what to make it a motor 9 (The ar mature is a three pole one.) A. Get somenne to measure the machines for you and calculate the necessary altera tions. These questions illustrate what we are receiving cause suffcient data are not given. 5. Is there any wa to make a + magnet and a - one 9 I mean by putting a ired. A. No : a positive pole cannot be produced with
and ut a minus pole. 6. What use is a condenser to an inuction coil A. To give strength and efficiency to the cischarge. . What la difference between a spark oil and an induction coil A. A spark coil has but which gives a spark on breaking the circuit. The induc tion coil has two windinge, and a current is obtained from the secondary whenever the current is made or
broken In tbe primary. 8. Also, how and what is a atep up transformer and a step down transformer, and what is the difference \& A. By a step up transformer the voltage of a current is raised and by a step down trans-
former it is lowere. Both are induction coils. We would recommend to you the purchase of Hopking' Ex primental Science, price $\$ 4$ by mail, and of the Elec rical Library, price $\$ 5$ by mail. From such booke you can obtain the answers to such questions
besides much other valuable information.
(7553) E. F. S. writes : For reply to question how to make an electric heater, you give me
mountand size of wire to connect to arc light circuit. mountand size of wire to connect to arc light circuit. candescent circuit, even if the heating capacity is ver mail. A. The directions for an electric heater are th or alternating. Divide the voltage of the circait by the number of amperes desired and the quotient is the number of ohms of resistance which must be used. The quantity of wire can then be found from tables. If German ailver is used, only one-thirteenth as much wire is needed as for copper.
much as of German silver.
(7554) W. B. B. writes: 1. I am build Whe the simple motor described in Supplement No. 641 Where shall 1 connect the battery to the machine, Fig. 9 Fig. 9. 2. Please state how to make the battery to the motor. A. You will find a battery especially adapt running this motar price 10 centa mall.
(7555) M. L. asks: What is the mean ing or derivation of the word "Breguet," need in depring"" The word is of course, French, Bend cannot ound in dictionaries. A. "Breguet" is the name of mon, 1747 wis Bregu drarn 1747, died 1829. See Webster's Dictionary, bio-
graphical section. His name is connected with his in-

## (755

(7556) A. C. S. writes: In your issue of November 19, under Notes and Queries in answer to
H. J. L., yon stated that the alternating current taken
from the street line can be changed into a direct current by the use of a rotary transformer. Will you please
publish in your paper for the benefit of the readers how such a transformer can be madep A. A rotary transformer is a motor and dynamo working together. It is used when a direct is to be changed to an alternating current or the reverse. The current to be transformed is ased to drive the motor part and the motor drives the dynamo portion to generate the current desired. As the machine is usually built. only one field winding is used,
but a double winding is put upon the armature, one of which is the motor circuit and the other the dynamo. We have not published the design for any such machine. A design is needed for each voltage to which the current is transformed. The company supplying the main cur(7557) J. L. B. asks: 1. Cau you furnish e with a process of cutting an oval-shaped hole from a plate of double thicknegs glass, without boring ? A. A hole is first to be drilled through the glass with a corner
of a file wet with camphor dissolved in turpentine. The plate should reet firmly on a emall block of wood directly ander the point of the tool, in order to avoid fracturing he glass. When the hole is drilled through it may be hole is to be quite large, it can be worked out to ite full size by a hot iron, carefully used, catting a narrow piece, each time starting from the holeand leading the crack into the hole a quarter way around. Patience and experience win, in time. enable you wo a good job. mary of an induction coil be made by A. It might answer for a small coli, bnt you had better build your primary up, adapting it to the secondary.

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## INDEX OF INVENTIONS

## For which Letters Patent of the United States were Granted

## JANUARY 3, 1899,

AND EACH BEARING THAT DATE.


