Manual of ELECTRO-COMBINATIONAL Engineering

First Edition

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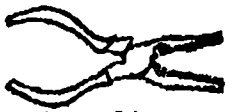
MANUAL OF ELECTRO-COMBINATIONAL ENGINEERING

I- This book shows how to make some electrical engines to demonstrate the principles of grammic analysis & combinational calculus as taught in our other works with which you should be familiar.

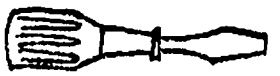
II- THE LO-GIN - This is a simple electro-mechanical device which solves syllogisms. (See "Barbara Cubed: The Manual of Pure Logic" for a full treatment of the science & art of pure reasoning.) Procure a rectangular wooden board, about a foot square, such as comes on the end of a box or crate, about a 1/2 inch thick. On the left & top margins drill sets of holes (1/4" in dia.) in pairs diagonally, four pairs on each margin & in line with these, in the middle of the board bore eight sets or pairs of similar holes to make the design of a logical-frame. Through the marginal holes pass the wires attached to the switches, tying them in a square knot on the reverse side to hold them firmly in place. Through the holes at the vertices of the framework pass the wires in pairs from the lamp-sockets & tie them also. Practically, it makes no difference which wire from a lamp is taken as positive or negative, but for uniformity & standard practice, we shall take as positive the wire attached to the central point at the base & as negative that joined to the screw-shell. It will be best to use a little extra time & determine these facts after you have tied the lamps to the board.

III- PROCEDURE TO DETERMINE POLARITY OF WIRES ATTACHED TO LAMP SOCKET - Attach the two wires from a plug-socket (such as comes with a string of Christmas-Tree lights) to the terminals of a No.6 dry-cell (the center one being the positive). Now, take another plug-socket & plug it into the first one, leaving the wires to attach to the bare ends from the lamp-socket, but first determine the polarity of these wires by using a small Ammeter. Thus the + wire in contact with the + pole of the Ammeter & the - wire touching the case (or negative pole) causes the indicator to move forward on the scale. Make a knot in the wire thus indicated as +, after trial. Now, make an extra lamp, attach its wires to another plug & insert the plug in the cell-socket, so that the extra lamp is lighted. Now, attach your free wires, one each to the wires from the lamp-socket on the board. Insert a bulb to see that it lights, then take it out. Now detach the knotted(+) wire from its end & put this same wire's end in the socket on the board so that it touches the central spot at the bottom of the socket. If your extra cell light now goes out, you have attached the

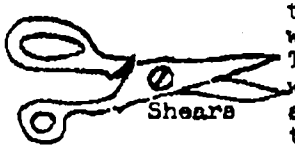
-TOOLS, Etc.



Cutting pliers

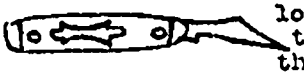


Small Screw-driver



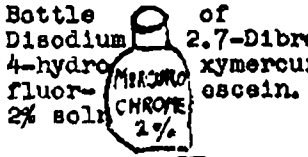
Shears

Friction Tape



Jack-Knife

Bit



Bottle Disodium 4-hydro fluor- 2% soln

Cake ---------of---------

wires in the wrong way. Transpose them & then the + free wire can make contact with the + point of the lamp socket without making the short circuit which puts out the extra cell lamp; but if you touch the screw-shell the cell-lamp will now go out. This is now the way you want it, so tie a knot in the free wire from the lamp socket & you will have the polarity properly marked for further use as to be prescribed. If you could follow the wires through from the terminals through the sockets etc, you would not need the ammeter, but it will be a handy instrument to have for other & similar purposes so it is best to have it among your equipment. It will also serve to measure the amount of current, etc. It is not necessary to determine the polarity of the switches, for this you can fix for

Bulb & In Socket

Symbol of Lamp

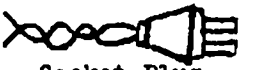
Miniature Mazda No.14 2.5V,.30A

Symbol of Leviton Push Switch

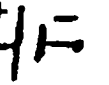
Connected Wires

Unconnected Wires

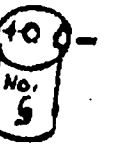
Symbol of Plug Socket Receptacle

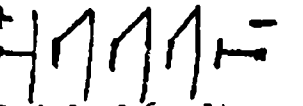


Socket-Plug

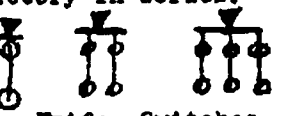


Single Dry-Cell 1-1/2 volts





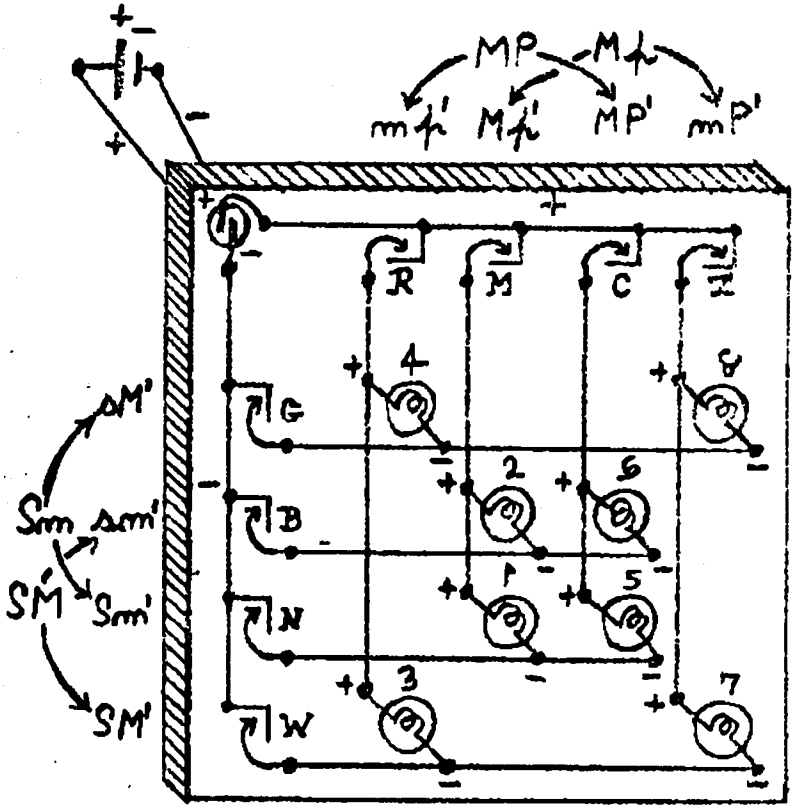
Symbol of 6-volt battery in series.



Knife -Switches Single, Double, Triple,

yourself,using the wire nearer the center of the board as that to which to attach the end from the lamps.

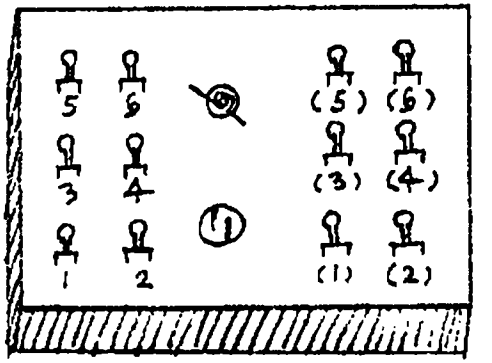
-IV- SCHEME OF THE CIRCUIT OF THE LO-GIN - This is shown in the chart below. The lamps represent cubic points & are numbered in the regular way for a Male Quicksilver Frame. They are connected in pairs vertically on the positive side

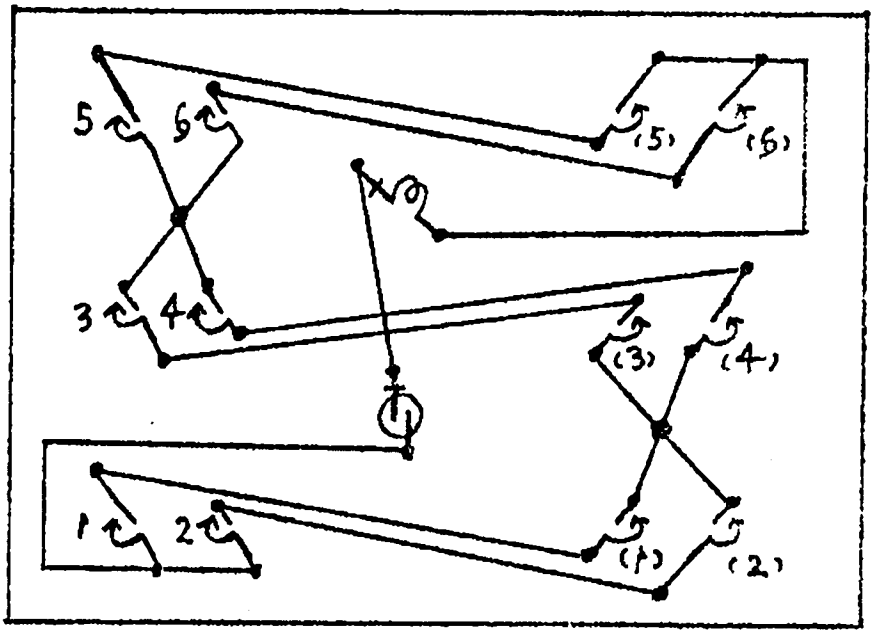


to make the salt (major) crystals & to the proper switch on the top margin; similarly the sulphur crystals are made by connecting the negative wires from the lamps in pairs together & to the proper minor switches. The four major switches are connected together with their other wires & to the + pole of the plug socket in the upper left hand corner,while the minor switches are connected together & to the - terminal of the socket. Now,put bulbs on the board, plug the battery cord in,have all the switches on with all the eight lights lit-up & you are ready to solve any of the 49 possible syllogisms. Thus,e.g. to eliminate the points of the R crystal you push the R

switch; to eliminate the N crystal you push the N switch. Our design shows outside of the margins the proper premises attributed to each switch. Note that when both terms of any premise are universal, it is necessary to cross-off two crystals in the same principal, hence, e.g. if the major premise be MP, you will push both the R & the C switch; then if the minor were SM you would push both the B & the W, leaving the #s 1 & 8, only, lighted, which is the conclusion. Here we must make note of an engineering deficiency in our design in its present simplicity; for while the #1 & #8 will be very bright & we shall have no trouble determining the right answer to the given syzygy, yet we shall find that, due to an indirect leakage of current, all the other lights shall be faintly illuminated. For practical purposes this will not matter & happens in only some cases. The student should endeavor to understand why this happens, since apparently it should not happen. There is a way to avoid this defect which we may describe later. In the meantime let us proceed next to make another simple machine, which will give you further practice especially in connecting switches.

V - THE TRIGRAMMATRON - The top, or obverse side of this board is illustrated here. For this we use toggle switches so that it will be evident when they are off or on. Two sets of six switches each are arranged to represent cradles of trigrams, one cradle at the left & the other on the right of the board, with one socket-receptacle at the lower center & one lamp in the upper center. Thus, to work it, we erect any one of the eight trigrams by pushing on the switch for yang or for yin in each of the three principals of the left cradle; then, if we push the corresponding switches on of the right cradle, the Lamp goes on. E.g., if we switch on 2 3 6, which stands for Yin-Yang-Yin, or trigram #6, then to light the lamp we switch on (2)(3)(6) of the right hand cradle & no other trigrammic combination will light the lamp, provided, of course, we push on but one switch from each pair. If we used the ordinary switch as in the Lo-Gin, the engine would work but unless we kept careful track of our manipulations at all times we might forget the precise pattern of offs & ons & hence be obliged to go through a part of the 64 x 64 possible combinations to put the machine back in working order. That would be rather inconvenient to do often!





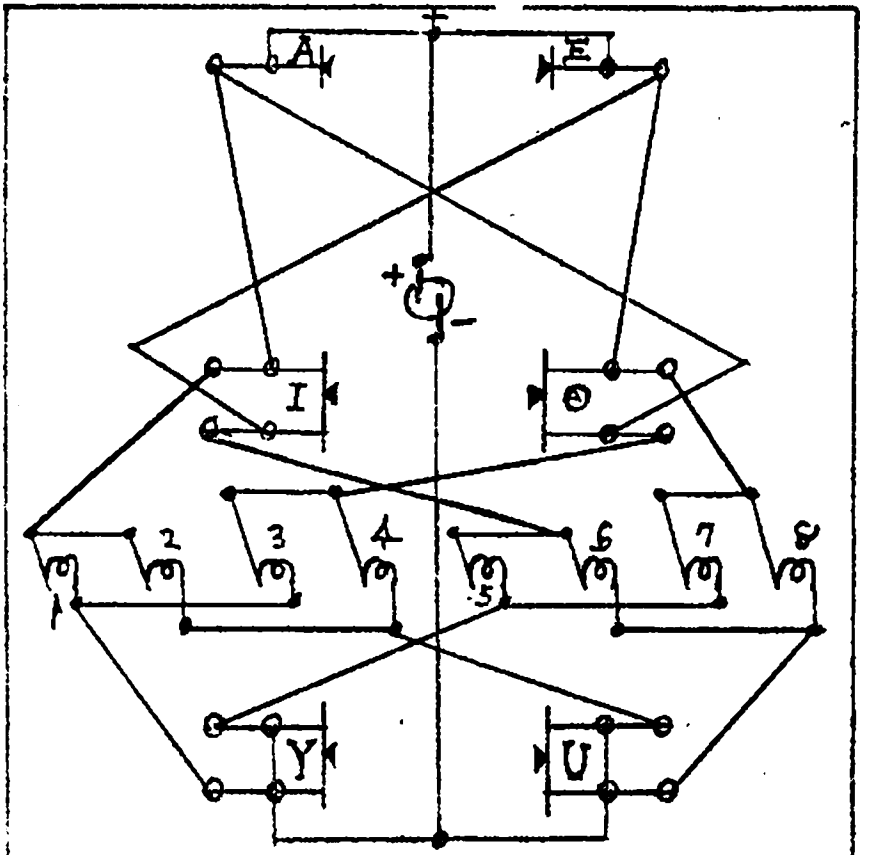
ELECTRICAL DESIGN OF THE TRIGRAMMATRON

The negative wire from the plug-socket is attached to one wire of switches 1 & 2; then the other wires from 1 & 2 go to ones of (1) & (2) respectively; the remaining wires from these latter are connected together & with both the first wires of (3) & (4), whose other wires go to 3 & 4, respectively & so on, as shown above, until we connect the pair from (5) & (6) together & to the minus of the lamp. Then connect the plus of the lamp directly to the + of the socket. Plug in your cell here, shut off all the lights & practice erecting & comparing trigrams systematically.

Here, we pause to explain that where extra wire is needed you should use rubber covered stranded. To make necessary joints whittle off the covering as much as needed without nicking the wires; twist the two ends together tightly & wrap with friction tape. Caution: always switch completely off or disconnect the battery when not in use & use common sense precautions to avoid accidents. Experience will give you confidence & skill but never allow yourself to get careless. Finish up each job neatly. Obtain the satisfaction which comes from working by the eight & ninety rules of art.

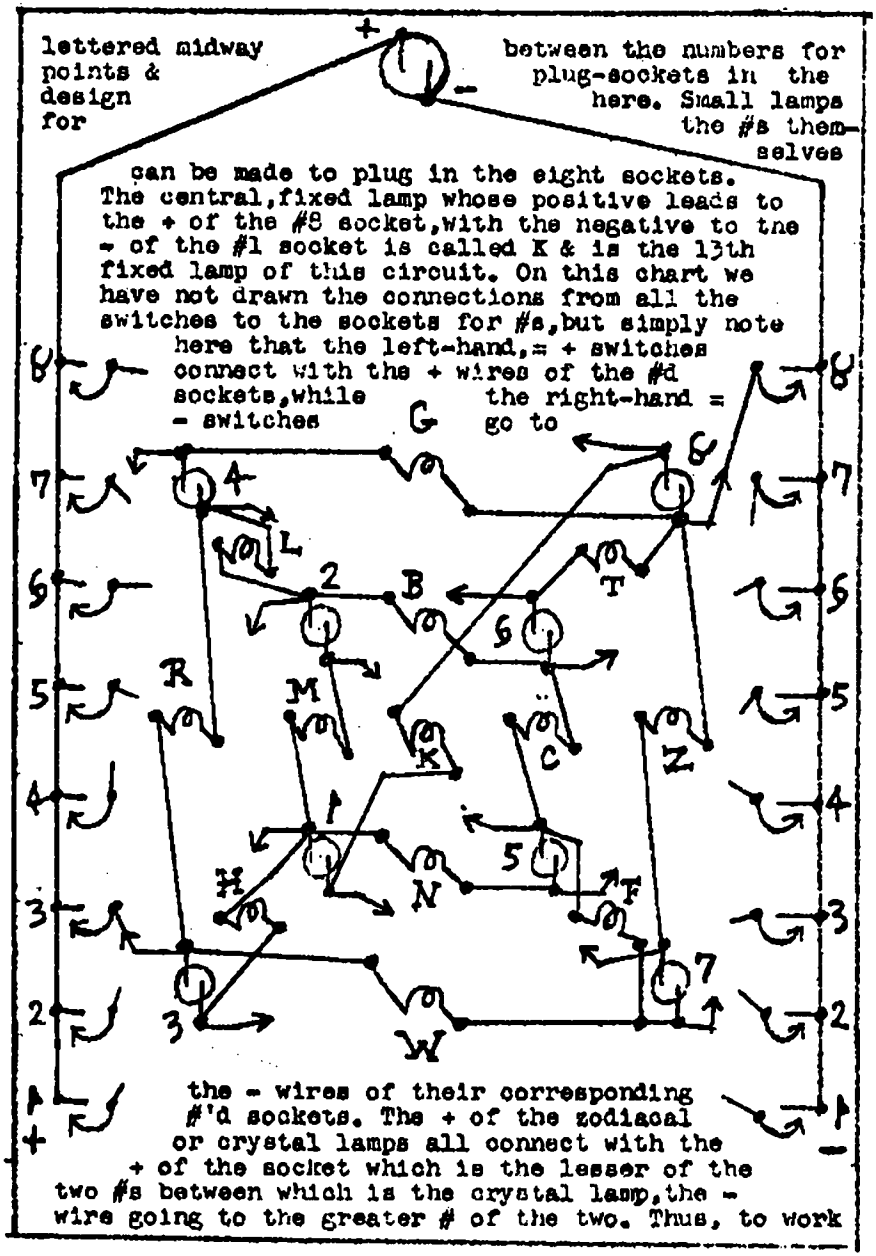
VI - THE CUBATRON - This engine lights eight lamps, which correspond to the eight #s of the cube, by using two sets of three switches each, one for the male metals & one

set for the female metals. Here we use knife-switches, a single pole for A & for E, & double poles for I & O, Y & U. The circuit is as illustrated below. For eight lamps, as here, it will be better to use two cells in series for the E.M.F. The Y & U switches are connected to the negative wires of the lamps & the minus end of the socket & battery. The I & O switches are connected to the + wires of the lamps & also to the A & E switches, which latter are connected also to the + of the socket & battery. Just as with the Lo-Gin & wherever else + & - leads are allowed to work against each other, there will be some current leakage here, but this will not detract from the obvious purpose of the machine, which works as follows. Begin with all switches off; then when you throw Y I A, #1 will light up; UIA will light #2; YOA will light #3; UOA will light #4; similarly- YIE puts on #5; UIE = #6; YOE= #7 & UOE = #8.



ELECTRICAL DESIGN of the CUBATRON

VII - THE ZŌ-TRON - This engine has twelve fixed lamps, as



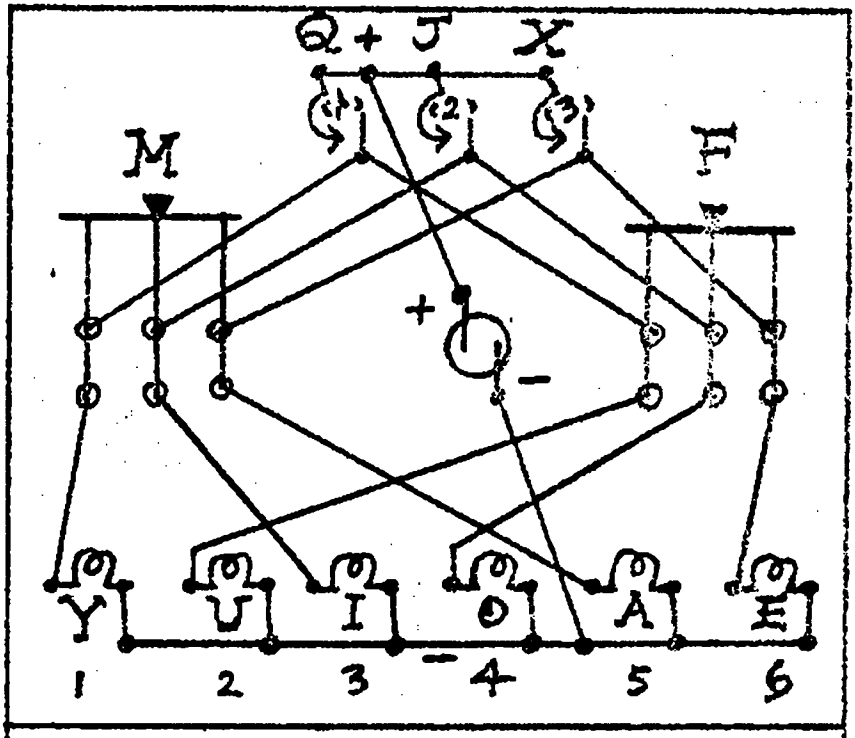
i.e. to light a crystal lamp, push two switches, one

from the + & the other from the - row. Thus, e.g. to light the M lamp,which stands for Aquarius, we push the + #1 & the - #2 switches; to light the T lamp for Leo, we close the + #6 & the -#8 switches, etc. Make Punctual Lamps for the eight # sockets by cutting the wires short & attaching them directly to the terminals of a socket-plug. This gives a very neat & attractive,little lamp. Note that it is possible to light the crystal without lighting the number, but that if two adjacent #s are lit-up, then the crystal between them must also be illuminated. Why? Naturally, there will be some of the hitherto mentioned leakage in this circuit; nevertheless you will find that this engine is one that is very interesting to make & operate.

A word here may not be inappropriate concerning the adopted nomenclature which in most cases should be of obvious derivation. Thus, e.g. we would have called this machine, a Crystomat, or a Zoongin, or something else; similarly, our first engine might be termed a Logatron, or an Electrolog; etc. We have in each instance, merely,chosen what sounds best to us at the time;as this science & art is perfected, the terminology will doubtless be improved. Suggestions from the student will be welcomed.

As a variation of the ZS-tron, the board can be designed so that the 12 crystals form a circle with the 13th also in the center & the # sockets either as here in a logical frame within the circle,or in a straight line,within or without the circle,in which case the switches can be put next to their respective sockets; similarly we can put the 12 & the 8 both in parallel straight lines. In any event the job of wiring must be done carefully & it will give you great satisfaction to have all lights work properly the first time the job is completed. Here we mark the + & - leads; note that the punctual trigrams apply,e.g. with #6 which is ⚊ ⚊ has two - & one + lead, the + to T & one - to ⚊ ⚋ B & the other to C. Note also that you can make + & - plugs to be attached to the battery,which here should be three or more cells, & put directly in the proper pair of # sockets, to light a crystal lamp; e.g. to light L put the + plug from the cell in the + half of the #2 socket & the - plug in the -, viz, right half, of the #4 socket; then lamp L will shine & nothing else but. There are other variations of this idea which the student should think about & work out. E.g., it may be made in three dimensions on a cubic framework; colored lamps can be used & so on.

VIII - THE SEXTRON - Here we have an interesting, little engine made with a row of six lamps controlled by three push switches for Q, J & X (or 1, 2 & 3) with two triple-pole knife-switches,respectively attributed to male & female. See design & description which follow.



DESIGN OF THE SEXTRON - This machine shows a trigrammic analysis of the cube. Thus, to put on any of the six

(*)	M	F	vowel or astral lights, representing, respectively the six sides of the cube,
(1) Q	Y=1	U=2	
(2) J	I=3	O=4	
(3) X	A=5	E=6	

it is necessary to close at least two switches, one from each set, viz- QJX & MF. Tabulate these two sets as parameters of the above cradle(*)

(**)

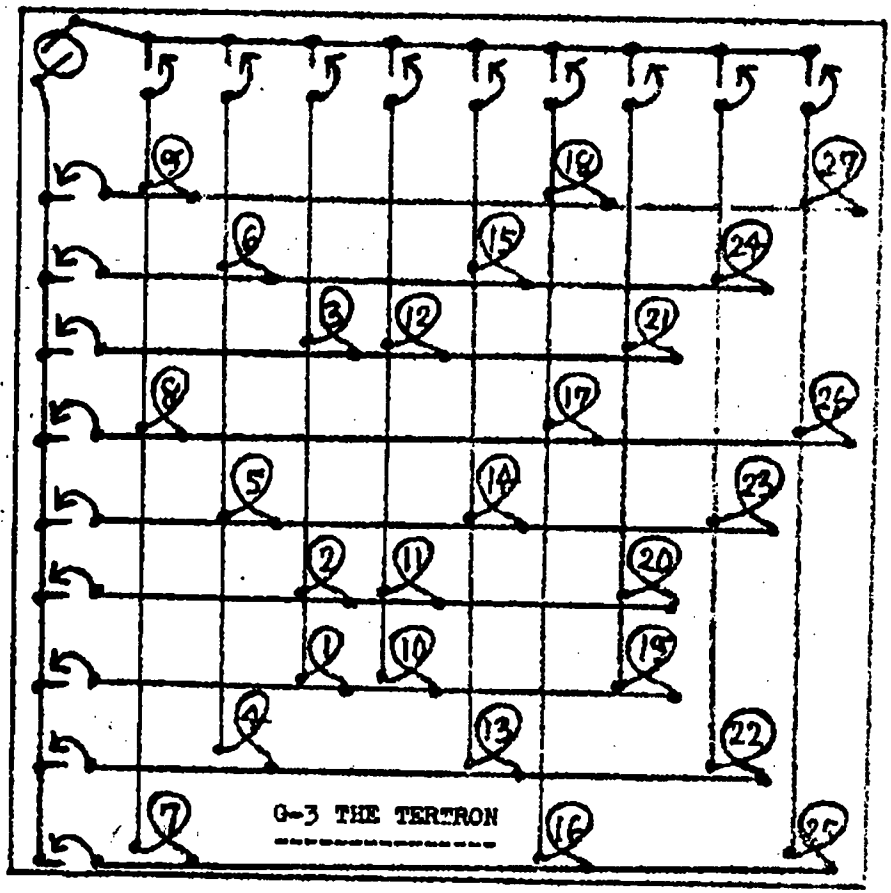
-1-	-2- M	-3- F	-4- MF
-0-			
-Q-	1	2	12
-J-	3	4	34
-QJ-	13	24	1234
-X-	5	6	56
-QX-	15	26	1256
-JX-	35	46	3456
-QJX-	135	246	123456

then, we see that the total of possible combinations will be thirty-two, = the product of the possible combinations of the minor times that of the major parameter. Thus, there are three switches on the minor & two on the major, yielding 8 combs. of the minor ($= 2^3 = 2 \times 2 \times 2$) with ($2^2 = 2 \times 2 =$) 4 combs on the major. ($8 \times 4 = 32$). Now, the zero combination, viz- with no switch closed on either parameter is the particle "0" = 1 x 1 of the above combinational table (**). Then, the whole first rank | 0 M F MF | consists of the four particles which are local products of the first(ordinally)combination of the minor parameter of (*) with, respectively, the

four combs of the major margin of the same cradle. As already suggested the 0 particle means that no switch at all is closed &, of course, no lamp lit. The M particle = 1x2, means that the M switch is on, but nothing closed on the minor parameter of (*); F means the F switch closed & MF means both M & F closed; thus the whole first rank moans no lamp lit. The 2nd rank (-2) of (**) is the product of the 2nd. comb of the minor parameter of (*) by the four combs, respectively of the major ditto. Here Q indicates that only the Q switch is closed, whereas -2-2-= 1 shows the result in the #1 light lit by closing just both the Q & M switches. Q & F light lamp #2= U & Q-MF lights both 1 & 2. Further study should make the rest clear & show that this engine properly worked enables us to produce 7 x 3, + 1 = 22 different combinations lights or patterns of illumination; the +1 being the legitimate double-zero comb- viz- total darkness, which must <u>not</u> be neglected in the analysis.

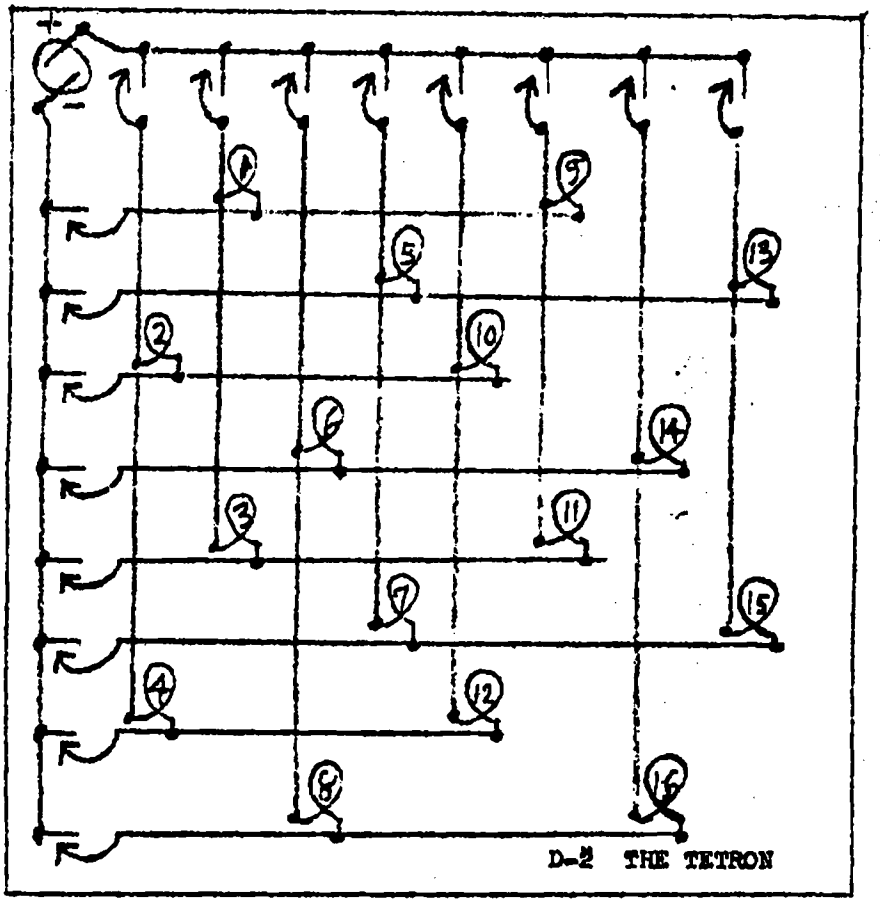
Cubically, the particles which, monads or single digits stand for the six metals or sides of the cube, respectively. The nine dyads symbolise crystals where adjacent sides are joined & complete principals where two metals or poles of the same principal are combined. The triads (two) may indicate #s1 & 8, or else the male & female metalic components; the three tetrads may symbolise 1234 = comb. of QJMF, etc & the sextrad, of course, the whole cube. Here, also, we can apply decoration by painting the upper half of the bulbs in the appropriate astral colors- viz- Y=silver-white; U = jet black, or dark brown; I = orange; O = bright blue; A = emerald green & E = blood-red.

IX - G-3, THE TERTRON - See illustration at top of next page. Here we have a representation of the third degree cube, (G-3), with its 27 #s symbolised by 27 lamps, the whole on a flat board, with the array of lights numbered as shown in the diagram, in rows, vertically & horizontally, of three each, standing for crystals with trichotomous polarity. Lamps are symbolised by a single loop with their #s inside the loop. Positive leads are connected to the 9 switches of the major margin, each of which is attributed to a salt crystal. Negative wires go to the 9 minor parametric switches for the sulphur crystals. Other leads from switches are linked to the respective poles of the plug socket. A 6 volt battery will work this machine, whose functions & characteristics should be plotted & tabulated by the technician. For variety, instead of drilling two holes diagonally in pairs for each # lamp, you may, if you find a bit of the right diameter, make a single hole for each in which the socket can be set down; this will economise on wire, as well as yielding a delightfully different effect. Note also the three-dimensional perspective which may be obtained, since the lights are specifically ordered for this, if you cock your eyes toward that end. This scheme also can be applied to an actual 3-dimensional configuration.



X - D-2, THE TETRON - See its design at top of next page. This engine makes an electrical incorporation of the second-degree Tetrak- 16 lamps for the 16 #s of this fourth dimensional configuration, arranged with a + & - crystal motivation, in the standard manner with which you are now quite familiar. There is no call to comment further upon this job.

XI - V-2, THE SEXTRATRON - We omit the design of this which the student can easily make up without our aid. It consists of 64 punctual lamps on a staggered framework. These may be worked with 32 switches on each parameter, for pairs; or you may use 8 instead, on each, for economy, in which case it would be equivalent to the regular logical square, 8 minors by 8 majors, 8 #s in each row. For this you will need the house-current & a step down transformer, like a toy-transformer, not one for a bell, as the latter heats-up too easily. Do not neglect the proper precautions.

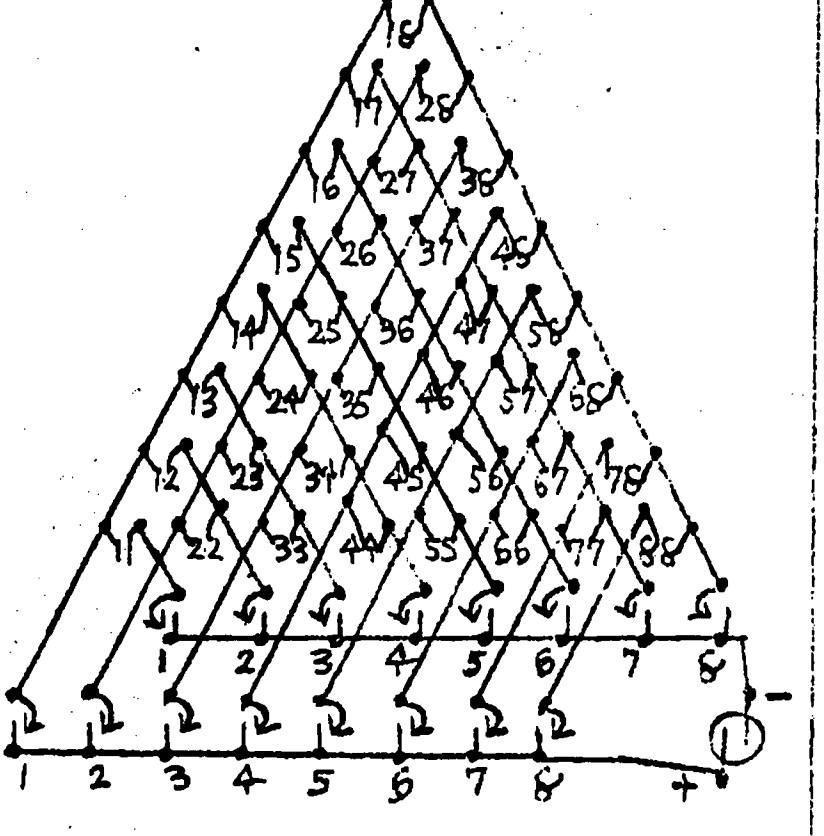


D-2 THE TETRON

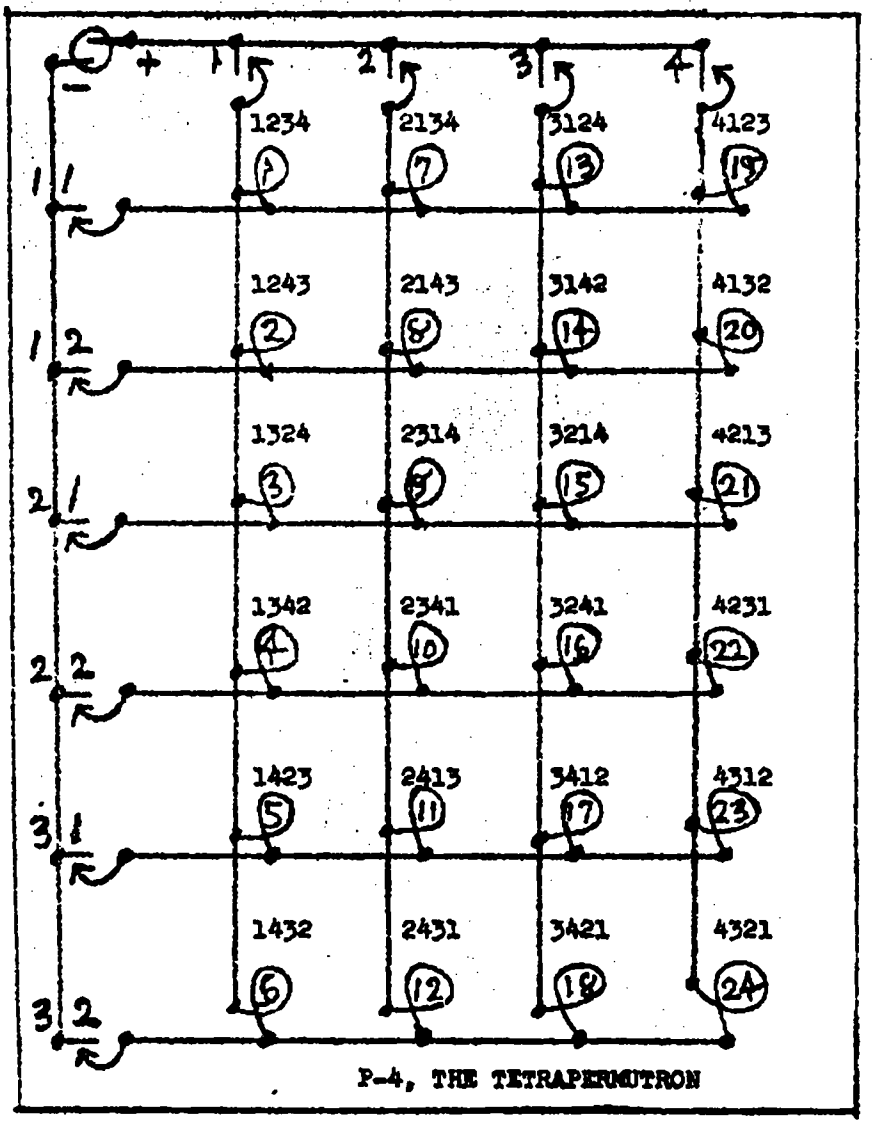
XI (Cont)- The 64 #s can also be arranged either as a cube of hexagrams, in which case you have HEXAGRAMMATRON, or as the regular sixth-dimensional figure with which you are familiar from Book PIH & The GRAMMAR OF CHANGES, q.v.

XII - THE COMPTRON - The design of this tops the next page & should be clear to the zealous adept; we have put the switches in two ranks, the - above the +. This device counts the switches as points with the lamps as their combined products, including the identity of each # with itself, making 8 x 7/ 2,+ 8 = 28 + 8 = 36 combinations as lamps. There will be 56 possible combinations of switches,two at a time making valid particles; however the arrays of many particles at a time will be very numerous; the mathematician can calculate the exact number by tabulation & comparison of the electrical validity of the products. Solve & answer!

ELECTRICAL DESIGN OF THE COMPTRON

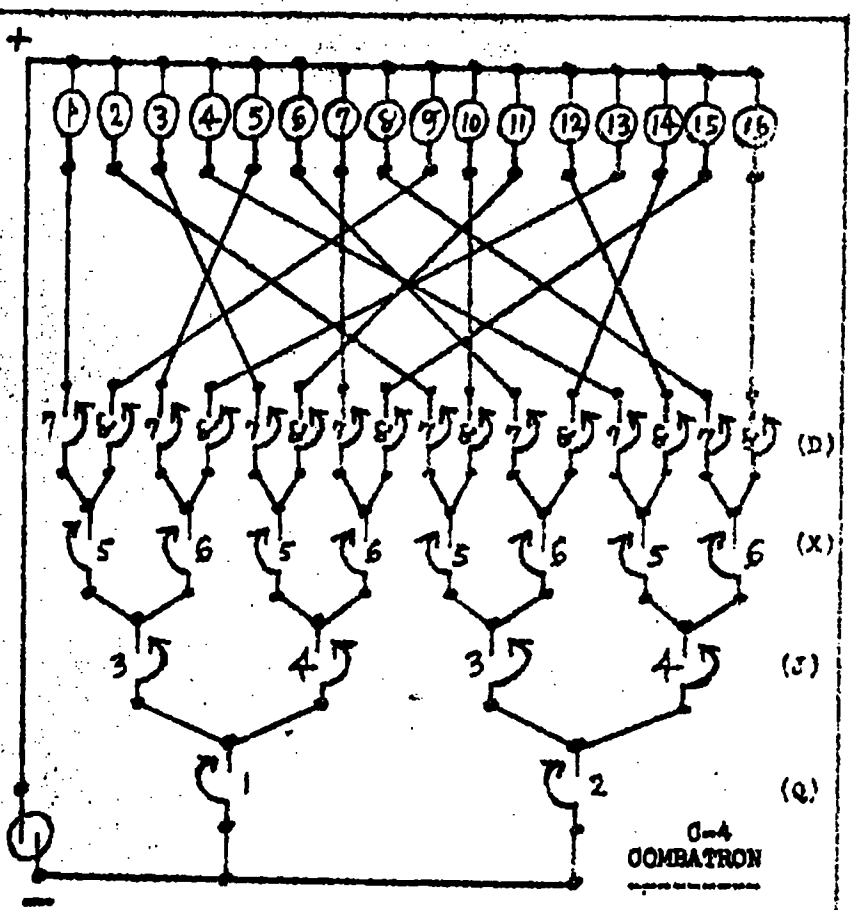


XIII - THE TETRAPERMUTRON (P-4) - Illustrated on the next page. This engine automatically counts the ordinal number of a fourth degree permutation. Consists of 24 lamps whose + leads go to four push switches on the major margin; their - leads connect with 6 switches on the minor parameter. The major switches are numbered consecutively from 1 to 4; the minors are numbered with the cradle selections which follow. The digit cradle is 1 2 3 4. To make a perm, select either the first, second, third or fourth digit for the first term of the perm & close the corresponding major switch. The second term of the perm will be either the 1st, 2nd or 3rd remaining cradle digit in sequence from the beginning; the third term will be either the 1st or 2nd remaining.



P-4, THE TETRAPERMUTRON

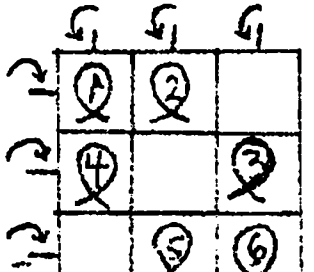
The fourth term is the last remaining digit, so needs no switch. E.g.; take perm, 3142:- push major 3; then for the minor, the 1 is the first, followed by the 4 which is the 2nd left after that, so push the minor swithh marked 12 & the perm # 14 will be lighted. Apply the Plus-One Algorithm, as explained our other books & you will see that this is the correct answer. The machine can also be used to determine the perm when its # is given, by reversing the above process. Please work this out carefully.



XIV - THE C-4, COMBATRON (Also may be called a Tetragrammatron, Polytron, etc.) This engine is designed to count, or tell the ordinal number of any combination, which can be made from four things. (See our "Combinational Arithmetic" for elementary explanation.) It consists of 16 lamps for the 16 different combs. & 30 switches. The + wires from the lamps all go directly to the + of the socket & the - leads go through the switches which are connected together in the fashion illustrated above. The switches are marked here with the metalic numbers of the corresponding grams of the pertinent polygrams. Odd numbers (1,3,5,7) refer to yangs & the evens (2,4,6,8), to yins. Erect the polygram, or combination, from the bottom up, the first place for the first principal, which will either be counted or not in the combination. When counted, push the switch in that principal which is on the right; if

not, then use the switch on the left-hand side, of the board, following. Thus, e.g., given the combination 23; the first principal is not enumerated, which means there is a yang in the corresponding polygram, so close the switch in the Q row, marked 1 (on the left); the 2nd or J gram is counted, so is a yin, so continue by pushing the following switch at the right (4 above 1); the 3rd or X principal is counted, so continue to the right by pushing the 6 (above the preceding 4). Now, the 4th or last principal (D) is not counted, hence is a yang, so go on to the left & push the 7 above the preceding 6. This makes the sequence 1467, which = the tetragram ⚊⚊. which is #7. Try another combination, say, 134. ⚊ ⚋ 3
The first principal is numbered, so push the 2 in ⚋ ⚋ 2
the Q row; the 2nd is missing, so go to the left ⚊⚊.
above the 2 & push the 3; the third & fourth are both there, so continue to the right for the last two switches, making the tetragram, 2368, which lights lamp #14. The student will note that if instead of reading the polygrams up, we read them down, then the switches would be connected to them by a simple dichotomous procedure, which would involve merely a reversal of the usual procedure of enumerating a combination. There should be no leaks in this machine since all the lamps are controlled by but one polarity. This method multiplies the number of switches; you can design this engine so that the D principal switches lead to the + socket, if you like, & then note whether or not there is any leakage. It can also be extended further into as many principals as you want to count combinations; a fifth principal row of switches would enable you to count all combinations from #1 to #32; i.e. that can be made from five things; six principals would count the combinations from six things, viz- #1 to #64, & so on.
To reverse the calculation & find what combination is numbered, say (11), simply start at the #11 lamp & close the switches back down to the - lead, viz- 8 = ⚋ ⚋ 4 ; erect the corresponding tetragram, with a 5 ⚊⚊ yin for the even numbers & a yang for the odds 4 ⚋ ⚋ 2 & enumerate the yins-(evens)-counting ordin- 1 ⚊⚊ ally from the bottom up, giving here the above pictured polygram which is the grammic symbol of the #11 combination = 2 4.

XV- TEST PROJECT - THE HEXAGIN - Make a six-light machine with + & - polar controlas suggested in the design here. Note that the major switches control 8 combinations, which multiplied by the 8 minor combs. yield 64 possible patterns, of which a number will be void. There will be 27 valid patterns of illumination, plus one complete null (total darkness). Make a practical circuit to illustrate this scheme.



Thanks to every thing!

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