"POPULAR TELEGRAPH INSTRUCTOR.

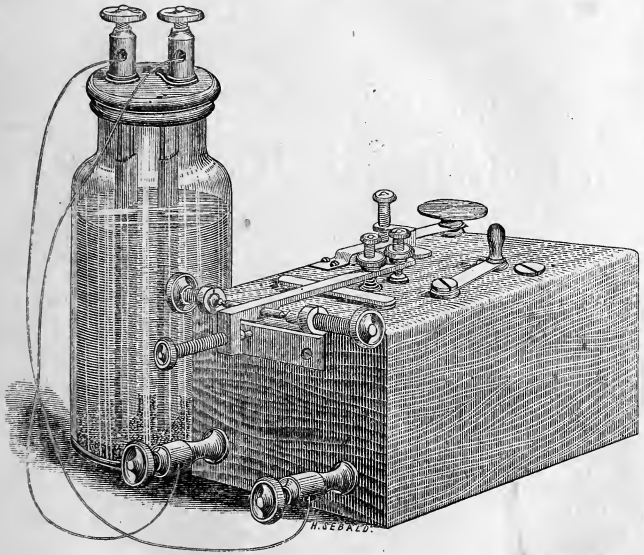
A RUDIMENTARY TREATISE

ON THE

ART OF TELEGRAPHING,

BY

ARTHUR POTTER."



Improved Telegraph Instrument for Learners, (See Appendix.)

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THE

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PHILADELPHIA:
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1870.

PREFACE.

This work is written with a view to popularize the Art of Telegraphing and for the use of beginners, in the hope that a more general knowledge of the system may lead to more extended usefulness of this modern mode of communication.

The acquisition of this art need not be looked on as a necessity for becoming a telegraph operator alone, but as a necessary element of education for Military, Naval, and Civil Service Appointment; for Railway Business; Bankers and Brokers Offices, and all large commercial establishments, where telegraphing is now adopted as an adjunct for facilitating business.

The probability of every person having it within their means to have telegraphic communication, at a cost little exceeding their own time for manipulating, makes a knowledge of the art desirable. In many places where the business will not pay for the services of a special operator, parties might send and receive their own despatches, for the fact of having a wire pass your door will ultimately be equivalent to having it for your own use, if the mode of operating is familiar

to you. Under such circumstances it will become as necessary to have telegraph instruments in your house as it now is to have a bell at the door.

That the present system and instruments are not so perfect as desirable, the writer admits, but the principles of the art being the same as in our verbal communications, the basis of all future improvements in telegraphing will remain as now.

The Author having studiously avoided all technicalities, and endeavored to make it a simple elementary work, trusts to its reaching the children, for whom it is intended, after those who select their studies, have read the preface.

THE ART OF TELEGRAPHING.

THE word "Telegraph" signifying to "write at a distance," (from "Grapho," I write; and "Tele," a distance,) is the same as speaking at a distance, for writing is but the representation of speech made sensible to the eyes instead of the ears.

For *speaking*, to be understood, it is necessary for the persons talking to know the language of each other, so that our power of speech may convey the thoughts of the mind to the person we are speaking to. Thus our daily conversation is only the exchange of sounds, in various combinations, that are understood only between those who have learned the same combination. The German, French, and English languages being only different combinations of the same sounds. The exceptions in all languages are that the deaf may read by sight and the blind by the touch or sound.

For any person to *read*, the rule for talking applies, for it is necessary to know beforehand the characters or signs that represent the thoughts of the writer; then the combination of these signs convey to the

mind, through the eye, the writer's expressions, the same as if they had been spoken.

In Telegraphing, it is also necessary for at least two persons to know the same signs, or communications at a distance would be impossible.

The signs now used in telegraphing are simple, and easily made known by simple mechanism, through any distance.

The Morse Alphabet, as used in this country for telegraphing, is made up of the following combination of signs, called dots and dashes:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
·—	—···	—·—·	—··	·	··—·	——·	····	··	·———	—·—

l	*m*	*n*	*o*	*p*	*q*	*r*	*s*	*t*	*u*	*v*
·—··	——	—·	———	·——·	——·—	·—·	···	—	··—	···—

w	*x*	*y*	*z*
·——	—··—	—·——	——··

These are the written signs by which the words are spelled, and can be written or embossed on paper (by means of electricity) at any distance. These letters are distinguished by the combinations, thus: (dot, dash, for a,) (dash, three dots, b,) &c. Some letters are called spaced letters, as c, o, r, y, and z, and known thus: (two dots, space, dot, for c,) (dot, space, dot, o,) &c., &c. The letter l is represented by a dash twice the length of t.

To learn these combinations thoroughly and to know them in every possible relative position they can be placed in, is the first step to telegraphing.

Learners should practice, by writing with these signs, words and sentences, calling out, as they write, each letter, the name and number of its combinations, thus: (dash, t,) (dot, space, two dots, r,) (two dots, dash, u,)

(dot, e,) — . . . . . — . "true." A little patient practice and perseverance will make the pupil master of the written alphabet. It is always preferable for two or more persons to study together.

The *signs* may also be represented by *sounds*, like ordinary writing, for instance, two bells of different tones may be used; strike one for dots, the other for dashes, and the ear will soon recognize the letters, by ding, dong, a; dong, ding, ding, ding, b, &c.

In practice only one bell or sounder is used, the tone being of no consequence, this is called "sound operating," and the dots and dashes are distinguished by marking regular time for each, the same as in music.

To make a dot, strike with a hammer as you count one and raise it instantly; to make a dash, strike and count four, then raise again. The dash taking four times as long as the dot.

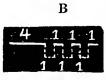
Telegraphing by sound is considered the most perfect operating, and to succeed in this, the art of sending distinctly is the most important, every sound must be uniformly distinct and made in the proper time to represent the letters, every letter must be equally distinct, and each word must be clearly divided from any other, this can be done with practice, whether the rate of sending is fast or slow.

To insure this uniformity of sending or signalling, the *spaces* as well as the *signs* must also be in marked time.

SPACING.

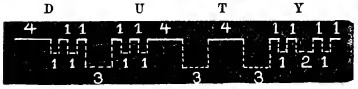
The space between *the parts of a letter* (except in spaced letters,) must be while you count one thus:

A: dot 1, space 1, dash 4.



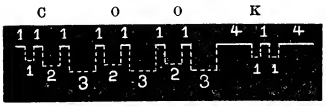
B: dash 4, space 1, dot 1, space 1, dot 1, space 1, dot 1.

The space between *different letters in the same word* should be while you count three, thus:



"duty."

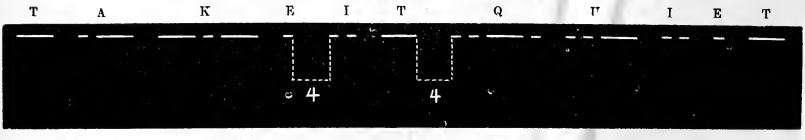
In *spaced letters* count two for the *space*, thus



"Cook."

The letter L may be prolonged to count eight and called long dash.

Spaces between *words* last while counting four, thus:



The following exercise will aid the memory, and two persons will be instructed at same time. Ask the questions in any irregular order.

QUESTION.		ANSWER.
What is dot, dash?	. —	A
What is dash, three dots?	— . . .	B
What is two dots, space, dot?	. . .	C

What is dash, two dots?	—..	D
What is dot?	.	E
What is dot, dash, dot?	.—.	F
What is dash, dash, dot?	——.	G
What is four dots?	....	H
What is two dots?	..	I
What is dash, dot, dash, dot?	—.—.	J
What is dash, dot, dash?	—.—	K
What is long dash?	——	L
What is two dashes?	——	M
What is dash, dot?	—.	N
What is dot, space, dot?	. .	O
What is five dots?	.....	P
What is two dots, dash, dot?	..—.	Q
What is dot, space, two dots?	. ..	R
What is three dots?	...	S
What is dash?	—	T
What is two dots, dash?	..—	U
What is three dots, dash?	...—	V
What is dot, two dashes?	.——	W
What is dot, dash, two dots?	.—..	X
What is two dots, space, two dots?	.. ..	Y
What is three dots, space, dot?	... .	Z

Reverse the last exercise by making questions of the answers, thus: What is A? dot, dash; &c., &c. Continue these exercises until the characters become familiar.

Persons engaged in any occupation where it is convenient to post a placard in view, should write out the alphabet in large characters and have it before them. This should always be done in schools or classes.

Exercises in schools on the blackboard will suggest themselves to all teachers.

The apparatus used for telegraphing by sound, consist of the battery, sounder, key, and connecting wires.

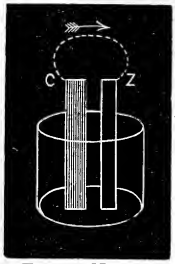


FIGURE No. 1.

No. 1 represents a pair of plates forming an Electric Battery, Z is zinc, C are copper, (or carbon.) These plates are placed in glass jars containing acid water solutions, one zinc and one copper in each jar, and connected by a wire from the copper in one jar to the zinc in the next, the dotted line shows the two end plates connected by a wire, and forms a circuit; when this is done the electricity generated in the battery passes around the circuit, and affects the whole length of the connecting wire whether it is long or short, the electric force being exerted in the direction of the arrow, but the action ceases when any connecting wire or part of the circuit is opened or cut, therefore the arrow only shows the result of *connecting* the two ends of the battery by a wire.

The connecting of the two ends of a battery by the ground, or earth, produces the same result as doing it by a wire, and is done in the manner shown in fig. 2.

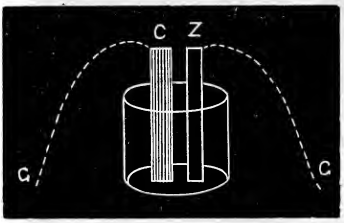


FIGURE No. 2.

The distance between Z and G or C and G is of no consequence, the Battery is set in action by putting the two wires into the ground at G G, and its effects influence the whole length of these two wires.

To detect the electric force travelling through the

wire several methods can be used, the one suitable for our purpose is called an electro-magnet.

The electro-magnet is a magnet produced by the action of electricity, it has the properties of ordinary steel magnets, and will attract and hold iron in the same way; but it is only a magnet so long as the electricity influences it, and the instant that influence ceases it loses the power of attracting iron.

An electro-magnet is made of soft iron rod, with covered wire wound around it several times, the covering is to prevent the wire touching the iron, or any part of the wire touching any other part.

The two ends of the wire of an electro-magnet, connected to the two ends of a battery at C and Z, will cause the electricity to pass through the wire and around the soft iron; while this takes place the iron is magnetized, and will attract and hold another piece of iron until the wire is disconnected from the battery.

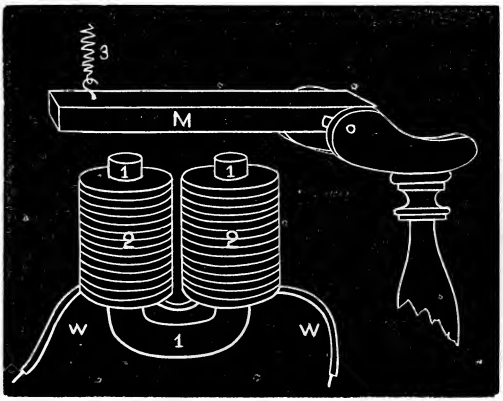


FIGURE No. 3.

Figure No. 3 is an electro-magnet bent so as to

bring the two ends near together, and the magnetism at each end acts together in attracting a piece of iron.

1, 1, 1, is the soft iron core.

2, 2, is the covered wire around the core.

3 is a spring to hold M away from the core.

W, W, the two ends of wire.

M, soft iron bar, supported above the magnet and called an armature.

The armature, if conveniently fixed, will be attracted by the magnet every time W W are connected to the battery, and is pulled back by the spring when disconnected from the battery, in this way a succession of downward and upward movements can be produced, the downward stroke having considerable force and producing very sharp and distinct sounds if anything is arranged to receive the blow.

A key is employed to make the motions of the armature regular, and at the proper intervals, for representing dots and dashes by these sounds.

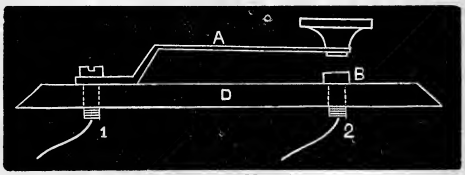


FIGURE No. 4.

Figure No. 4 represents a simple key.

A is the finger key of spring metal.

B is a metal stud screwed through D.

D is a wooden base to which A and B are fastened.

1 and 2 are wires attached to the screws on A and B.

Connect 1 and 2 of key to C and Z of battery, and the battery will extend to A and B.

Now press down A until it touches B and the battery

circuit will be completed, so that the electricity passes from one end of battery through the key and back to the other end of battery. It will be seen by this, that wherever there is a continuation of metal that the electricity will traverse it.

To hold down A while you count one will set the battery in action to represent a dot; to hold it down while counting four, a dash; therefore all the *signs* or *sounds* are produced by the length of time the key is held *down on* B, and the spaces by the length of time it remains off B.

The following sketch illustrates the manner of connecting the complete apparatus for working one instrument.

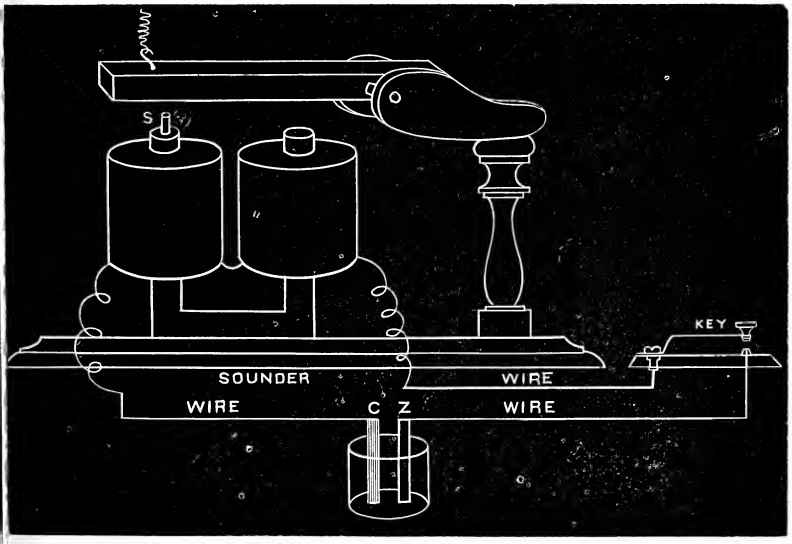


FIGURE No. 5.

Figure No. 5 shows the arrangement for working

one sounder only, and it should be noticed that the wires connected with the battery make a complete circuit through the whole apparatus when the key is depressed.

Completing the circuit of the battery is the only way to set the electric force free to perform the work required.

As a downward motion of the key produces a downward motion of the armature, sounds of different duration can be produced on the sounder by operating on the key.

The stud S (Fig. 5,) on the top of one end of the electro-magnet, is made of copper or brass and inserted in the iron core, the purpose of this is to receive the blow that produces the sound, and to prevent the armature from touching the cores as it is attracted towards them.

If the armature is allowed to touch the cores, they acquire some permanent magnetism and the instrument is thereby injured. To prevent the contact between these parts, adjusting screws are generally used, and the learner must always remember what they are for and adjust accordingly.

Figure No. 6 shows the method of connecting the wires between two distant offices. One end of the battery at each office is connected to the ground; in one office zinc to ground, and in the other copper to ground; and the opposite ends are connected to the instruments. The ground connections are generally made by attaching one end of the battery wire to either a gas or water pipe that is laid under ground, in the absence of these, bury a piece of copper in the ground, where it is moist, and attach your wire.

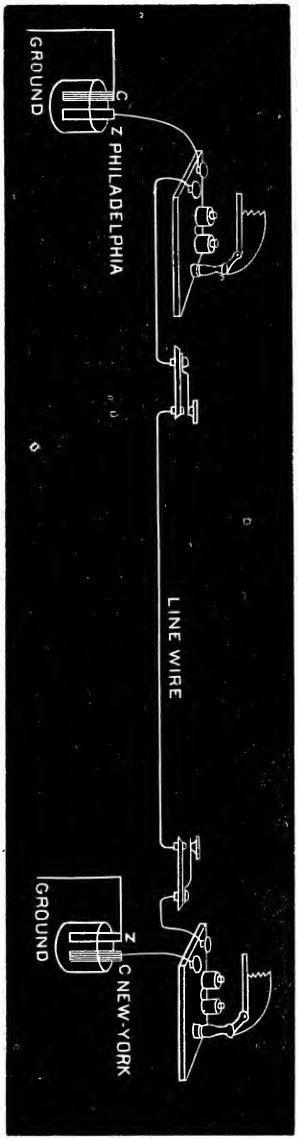


FIGURE No. 6.

The use of the ground saves one wire, otherwise two wires would be necessary to complete the circuit of the battery, the space between the two ground connections may be considered by beginners the same as the dotted line in fig. 1.

The ends of the batteries passing through the instruments to the

line, it will be observed, are also different at the two ends, one being copper and the other zinc, this is necessary, for the two batteries have to work as one, and for a battery to work perfectly the plates must be arranged alternately, copper to zinc, copper to zinc throughout. The copper in New York connecting with the zinc in Philadelphia makes this continuous arrangement in proper order, only one pair of plates has a long wire and the instruments between them, while the other plates are connected by short wires from one jar to another.

If the battery wire (Fig. No. 6) is traced, it will be seen that the electricity cannot pass along the line in consequence of the keys being open at both ends, so that neither end can communicate with the other, because the circuit is not completed when you put down one key. To obviate this a switch is used to complete the circuit when the keys are up.

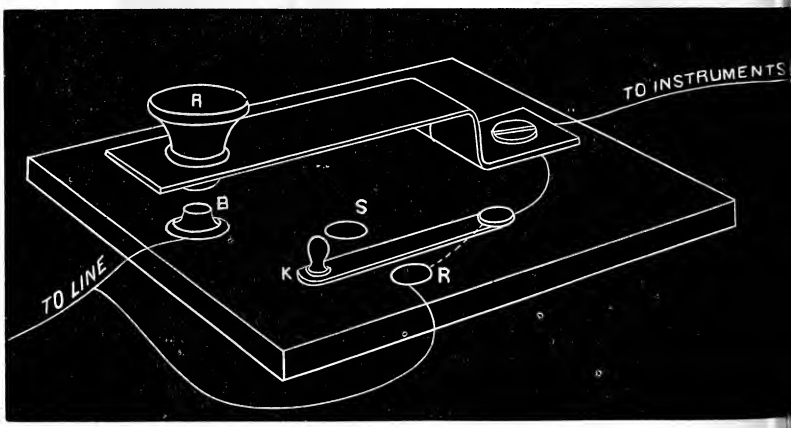


FIGURE No. 7.

The switch K (Fig. No. 7) is moved either to the

right or left until it rests on the studs R or S. On R for receiving and on S for sending.

When receiving, the line continues from B to R through switch to back of A and instruments.

When sending, switch is on S, and the line continues from B to A as you depress the key.

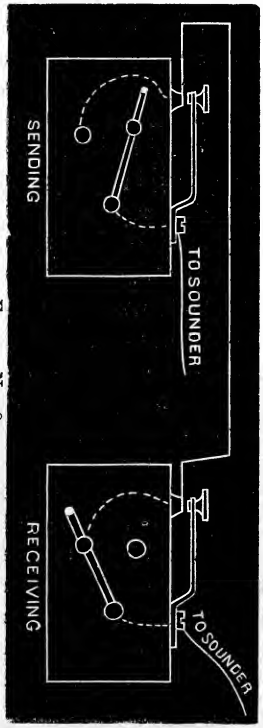


FIGURE No. 8.

Figure No. 8 shows the position of the switches at two offices when working.

The importance of this switch has led to several attempts to supersede it, but not very successfully, for the switch is still in general use. Its importance arises from the fact, that any neglect to use it properly, stops all communication. For sending and receiving it *must* be in the position indicated in figure No. 8. With beginners, there is great danger of the switch being left in the wrong position, and too much attention to this subject cannot be possible with learners, it is as essential as the alphabet itself, and its prompt and proper use will save much annoyance and delay when working on a line.

After sending a message with the switch on S, turn it instantly to R, which is the proper position for all

switches when not actually working, this enables either office to receive the call signal.

The call signal may represent any letter or letters previously agreed upon, say P for Philadelphia and Y for New York.

To call the attention of either end, repeat the signal of the office you want until answered by the same signal, this indicates that the office called is prepared to receive your message, which you may now send.

Office practices, however, are minor matters and vary on different lines; these are easily acquired when duty in an office requires it.

Figures and punctuation are signalled by special signs, but learners will do well to let them alone until they have acquired some proficiency in operating.

To become a good operator much patience is demanded, impetuous and careless sending is intolerable, and no excuse can be made for any exhibition of passion or want of forbearance while working. If your sending is not at first understood by the receiver, repeat it *carefully* and *distinctly* until it is, the receiver will thus feel encouraged and gain confidence, and the work between the two will soon pass on smooth and pleasantly.

Learners may, as they progress, desire to know if they are competent operators, the writer can only say that to excel in the art requires constant practice, and to become a professional operator you must have considerable experience in a telegraph office, the stepping-stone to this is the thorough mastery of the rudiments, and a passable capacity for reading by sound.

Some persons, probably, could never become operators, though the writer in his experience has known a child of six years, and a man of forty, become very fair

operators in a very short time, the one being adapted and the other determined, two very necessary qualifications in this as in all studies, if you do not possess one or both of these attributes you will never be what is worthy the name of "Telegraph Operator."

APPENDIX.

FIGURES.

1	2	3	4	5	6	7	8
.——.	..——..	...—.	....—	———	.....	——..	—....

9	0
—..—	——

PUNCTUATION.

. Period,	. .———..	! Exclamation,	———.
, Comma,	.—.—	' Apostrophe,	.—.—.—.—
: Colon,	.—.—.	¶ Paragraph,	————
? Interrogation,	—..—.	Italic,	—...—
——— Underlined,		.... (Parenthesis,)	....

.. .. "Inverted Commas," .. ..

The three last signals are sent before and after the words or sentences intended to be so written.

DESCRIPTION OF THE LEARNER'S INSTRUMENTS.

The two binding posts at the back are connected with the coils of electro-magnet. The battery wires are attached to these posts as shown in the engraving.

On the lever of the armature are three adjusting screws; one at the back end regulates the distance which the armature is to be from the ends of electro-magnet when it is up, this must be sufficient to give full play to the armature, which must always be within the attraction of the magnet.

The second screw, in middle of lever, has a spring under it to lift up the armature when the key is up. This should be regulated to suit the strength of the battery, by screwing it downwards when the battery is strong and rapid signals required, and by turning it upwards when battery is weak.

The third screw, on front of lever, is for regulating the downward stroke of armature, and must be adjusted so that the armature may come very close to the electro-magnet, but not to touch it.

The Electro-Magnet is inside the box and the two ends or poles can be seen under the armature.

The Key on the right hand side has an adjusting screw over it, this regulates the motion of the key, which should never be very short for beginners but may be set closer as the pupil progresses. The points where the key and the stud under it are connected by working must be kept clean, this can be done by put-

ting a piece of paper between them, pressing the key down and drawing the paper out from between them.

The Switch on left hand side is used for working with one or more instruments. When working only one instrument the switch remains on stud S for sending. When two or more instruments are connected, the switch is on S for sending and turned on R for receiving; the switch and stud must be kept clean where they connect.

The Battery, consisting of one pair of plates, is sufficient to work an instrument through a short distance, but if two instruments are connected the number of cups must be increased according to the distance between them. Parties wanting extra batteries should say for what distance.

The battery, supplied with these instruments, has a spare bottle which should be kept empty, and whenever the battery is not in use the plates may be removed from the solution and placed in the empty bottle, this will make them last much longer, and they will be in action for use as soon as they are replaced in the solution.

The zinc plate is amalgamated with mercury by cleaning it thoroughly with dilute sulphurite acid and brushing it over with mercury until it is completely coated.

When the battery becomes weak, the plates must be washed clean and the zinc recoated with mercury as above, when the original coating disappears.

The solution must also be renewed from time to time according to the amount of work the battery performs.

This battery will work with a solution containing one part of sulphuric acid and about twelve parts of clean water, or a better solution called "Electropoion"

is made as follows: Five ounces bichromate of potash dissolved in a pint of hot water. Then in a separate vessel mix half a pint of sulphuric acid in a pint and a half of cold water, mix the two thoroughly and the solution is ready for use when cold. Mix all solutions in stoneware and not in glass.

All battery solutions are more or less destructive to wearing apparel and every kind of fabric, consequently great care must be taken to place the battery where it cannot be upset; splashing of the solution or putting the hands into it must be carefully avoided. *The solutions are all poisonous.*

When mixing sulphuric acid with water be sure to pour the acid slowly *into the water*, and *not* the water into the acid, this will prevent accident.

Sulphuric acid is very liable to splash if poured out too fast, and may destroy whatever it touches if not removed at once. Stains on clothing, carpets, &c., produced by this acid, can be removed by rubbing the spots over with hartshorn or spirits of ammonia.