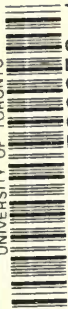


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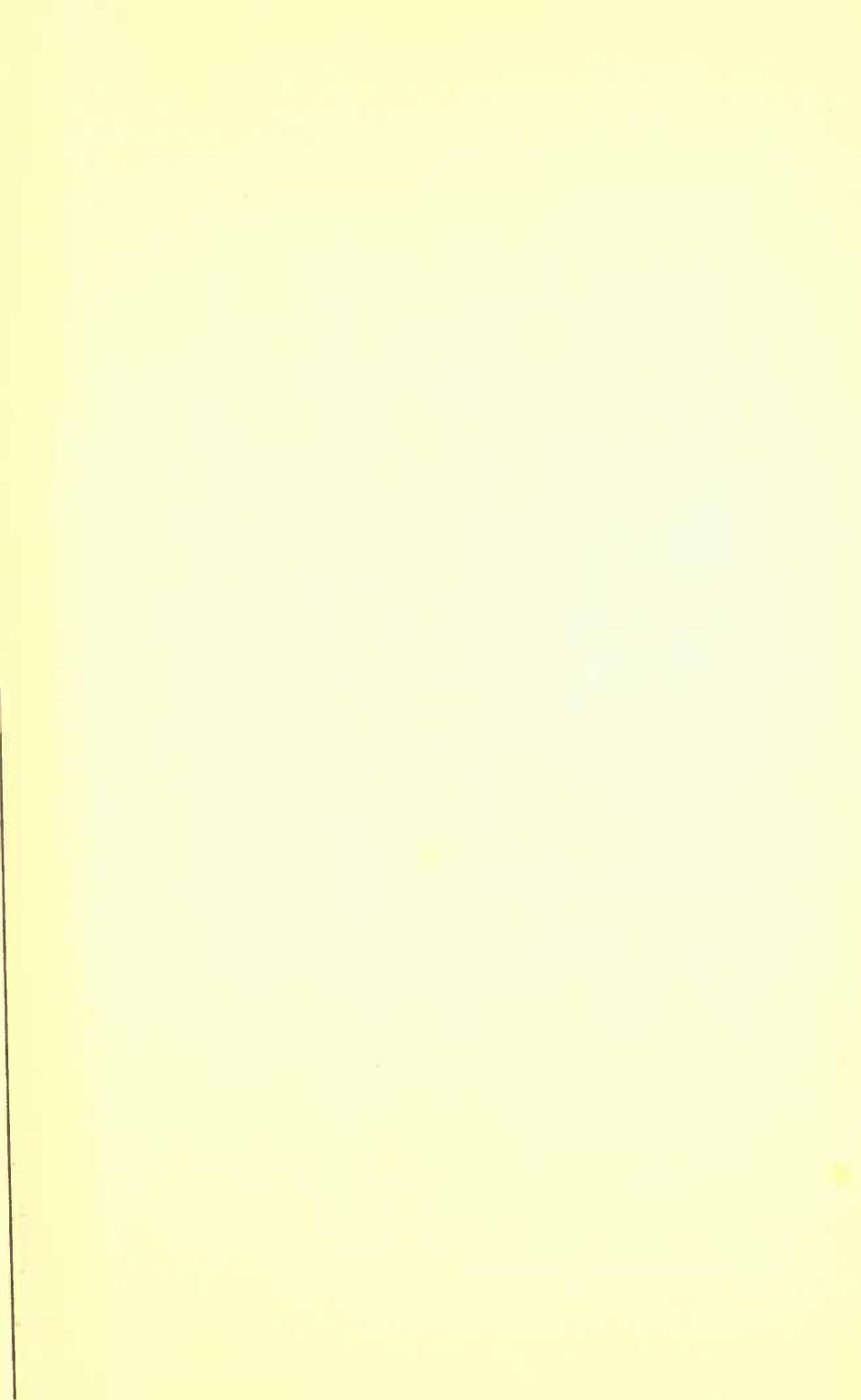
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THE  
PROCESS OF THOUGHT  
ADAPTED TO  
WORDS AND LANGUAGE.

TOGETHER WITH A DESCRIPTION OF  
THE RELATIONAL AND DIFFERENTIAL MACHINES.

BY  
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## P R E F A C E.

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THIS little volume constitutes a further contribution to the Electro-biological series of works which have now occupied my attention for a long period. They may be said to have been commenced many years back; and some part of the labour was even undertaken whilst still a student of medicine. On attending the Physiological Lectures of Professor Mayo, I was remarkably struck with the unsatisfactory account of the functions of the brain, and I was surprised that so little appeared to have been done in connecting mental operations with that organ to which they were due. I had not only the advantage of studying under this gentleman of genius, who is so well esteemed for his knowledge of the nervous system,

but I had also the good fortune to continue my studies under Professor Todd, who is also greatly distinguished for his acquaintance with this branch of Physiology.

From that period, I determined that I would endeavour to base some system of mental philosophy upon the functions and structure of the nervous system, and endeavour to compare it with the observed facts in mental science. In my earlier experiments, I found that a thorough knowledge of Galvanism, in addition to an acquaintance with other physical forces, was necessary. Although a pupil of the late Professor Daniell, yet, nevertheless, I found that in that science much had practically to be learned; and in acquiring that practical knowledge my Voltaic Battery was developed, and the materials for the Elements of Electro-Metallurgy worked out and adapted for the purposes of the arts. In seeking further information upon physical forces and their mutual relations, the work on the Sources of Physic was written.

Proceeding onward with my experiments and investigations upon the subject, it appeared to me

from the results which had been obtained, that the whole might be usefully classed together under the general term of Electro-Biology, which literally signifies, neither more nor less, than the relation of electricity to the vital functions. Upon making enquiries, it seemed to be a universal opinion amongst those qualified to judge, that a very small number of copies of the work would be sold, inasmuch as the public had great distaste for such investigations. Nevertheless, a large edition was printed, and certainly its rapid and extensive sale has been a matter of astonishment to myself, more especially as there is not only a French translation, but the substance of the work has been very faithfully given in *Chambers' Journal*. The facts and principles have also been so carefully rendered by the Newspapers and other cheap publications of large circulation, that there are very few educated persons who are not more or less acquainted with the subject.

Many friends, whose opinions I value, have suggested that the matter has been hardly sufficiently elucidated; but, in answer thereto, it is right to state, that my object has been to place

the entire system before the Public in so small a space that any inconsistency or incorrect deduction, in any part of the scheme, may be immediately seen, and dealt with at once. To remedy, however, the defect of the abstruseness of the work, and render the subject more attractive, the treatise on Instinct and Reason was written and illustrated with numerous engravings.

It has been mentioned to me, on several occasions, that I do not take any pains to persuade the public, and induce them to take up the system I have developed, and which confessedly requires intense study fully to grasp. To this, I reply, that in my opinion it is neither consistent with the interest, nor with the dignity, of science, in any way to endeavour to induce any person to adopt any system; but, having made known its existence, it should be left to the diligent inquirer, who should, in his closet, carefully examine every fact for himself, and hold fast to that opinion which his natural powers of mind lead him to adopt. No true lover of science can possibly wish that his own investigations should do more than exercise their proper influence upon the sum total of that knowledge

which the labours of the philosophers of all ages have developed. Science loses its character when it is used solely to gratify the personal vanity, or either to make a name, or to give a fortune to its follower.

Although the system of Electro-Biology has extended with a rapidity, both at home and abroad, which even an author's sanguine expectations could not have led him to anticipate; yet many difficulties are opposed to its yet more rapid progress. The misapprehensions of other writers upon the subject, cause them to publish statements at direct variation with my meaning; and after three works have been already published, each explanatory of the subject, the reader may judge my inexpressible astonishment, at reading, a short time since, that Mr. Smee had asserted, that "Life was Voltaism," followed by a long argument to prove the incorrectness of the assertion!

Misapprehensions may arise from my own ambiguity of expression, or the reader's insufficient attention, or from the imperfection of words and language to convey exact ideas; but I regret to state that one or two instances have occurred

where there has been reason to fear that my words have been wilfully misrepresented, and statements have been put forward directly at variance with that which has been explicitly stated. This course, fortunately however, is so directly contrary to the practice of the literary men of this country, as to require no further comment.

This volume is a deduction from the general system of Electro-biology; and being a practical application of the subject may possibly be immediately useful. In submitting it to the Public, I am not without hope that the process of thought here detailed, and the artificial system of reasoning here given, may be of service, more especially as I dare venture to assert, that under the Relational system, if rightly used, no form of sophistry or quibble can be successfully employed; and it has the merit of allowing any number of premises to be used.

With respect to the relational and differential machines, it may, perhaps, be useful here to repeat, that they are described solely with the view of illustrating the artificial mode of reasoning, by the



aid of cyphers, which has been based upon the study of the laws deducible from the natural process of thought.

From the nature of the subjects on which I have been engaged, my writings have been much noticed, and whilst they have been too frequently the subject of immoderate praise, they have also, occasionally, received unmeasured abuse. It is customary only to quoted the good side; but I have been often amused to observe that opposite quotations could be selected upon every definite opinion. From my experience, whenever anything is violently abused, it is contrary to some favourite crochet, or popular prejudice, for which the holders venture an expiring struggle before it is for ever lost. Although quiet and repose might dictate to an author to bend to the follies or prejudices of the day, yet, to my mind, an author should faithfully record the results which he has derived from his own reflection and reason, without regard to the possibility of receiving abuse, or the desire of obtaining praise. Under the influence of this opinion, I have never, in any way modified my views, or kept back facts, to suit the public taste; and ex-

perience shows me that that course alone is satisfactory to the author, secures in the long run the respect of the Public, and what is above all, commands the respect of the writer's own conscience.

The whole work must be regarded as but a brief outline of the subject. On this account, it has neither fallen within the scope of the work, nor has it been in accordance to my own inclination to compare this system with the systems of others previously published, and which have been employed to the best of my ability whilst writing it. The study of these subjects affords to the mind the highest pleasure; and although the development of this book has already been a pleasing employment to myself, yet if it should be found of corresponding utility, it will in future years be an additional source of gratification.

7, FINSBURY CIRCUS.

*March 18th, 1851.*

# PROCESS OF THOUGHT,

ETC.

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## CHAPTER I.

### ON THE NATURAL PROCESS OF THOUGHT.

- (1) Art does not enhance the natural perfection of Man.—  
(2) Reception of Ideas.—(3) Limitation of Ideas.—(4) Changing Ideas.—(5) Memory.—(6, 7) Powers of Mind.

(1.) THE perfection of the operation of the brain, by which man performs the noblest attributes of his nature, can no more be enhanced by a knowledge of its organization, than the working of a steam engine could be improved, if it could be made to know the mechanism by which it obtained its desired result. Nevertheless, it is practically found that a study of the laws of mental operations is advantageous, inasmuch as such knowledge inspires confidence to its possessor, enables him to check any result which he has obtained by the natural process of thought, and thus adds a confirmation to his opinion previously formed.

(2.) Electro-Biology teaches that man receives impressions from the external world through the medium of his organs of sensation, transmits those impressions to the brain, and there registers them in certain combinations in such a manner, as to render the sensorium one vast mechanism, in which everything which has been heard, or seen, or felt, or smelt, or touched, has produced an effect which modifies the action of any impression which may be subsequently received.

(3.) It would appear then, that every idea, or action on the brain, is ultimately resolvable into an action on a certain combination of nervous fibres, which is definite and determinable, and, regarding the sum total of the nervous fibres, is a positive result over a certain portion only, which has a distinct and clearly defined limit. Thus, if we take ten nervous fibrils, and call them A B C D E F G H I J, and suppose an action to have occurred on D E F, the combination excited to action, will give rise to an idea which would depend upon their positive excitement, and the positive character of the idea would be limited to that combination. Instead of using the letters D E F, I may illustrate the proposition by assuming the fore-finger to represent those letters, when it would be apparent, that if that finger was placed in hot water, the idea of that particular action of the hot water would be confined to the nerves supplying that part.

(4.) The operations of the mind would be very simple, if they could be reduced to ideas of so simple a character; but in a state of nature, various ideas are represented to the mind continually varying: thus—whilst I write, the gas-light and fire-light excite the nerves of my eye, the crackling of the burning embers excites the nerves of my ear, and I feel the pen which enables me to communicate my thoughts. These different ideas are represented over a varying length of time; and their relations to each other are the source of our notions of Time—of Motion—of Cause. To illustrate my position by symbols, we may have A B enduring for some time, and whilst continuing, C D may come into play and pass away for E F, and then in their turn to pass away for G H, when A B may finally pass away, and C D arise; and at last D E F G may alone remain. Thus we should have several distinct ideas represented successively to the mind.

(5.) Ideas once implanted, may appear again to the mind at some future period, either as they were at first received or conjoined with other ideas, when the effect is termed an act of memory or thought; and this is distinguished from a reality by its being unaccompanied by an action on the nerves of sensation.

(6.) The mind has the power of combining a number of ideas to form a general law, or of

#### 4 OPPOSITION BETWEEN PRESENT AND FORMER IDEAS.

lysing a general law into the specific instances from which it has been induced. Lastly, it may analyse any specific idea into the combination of nervous fibrils excited.

(7.) When any new impression is received, the mind can determine the accordance or discordance between it and former ideas, or can determine the similar relation which exists between previously received ideas.

Such are the few leading powers which the mind possesses to conduct its operations; and the laws of their action will be found to comprise every case of mental operation.

## CHAPTER II.

### ON WORDS AND LANGUAGE.

(8) Memory.—(9) Communication of Ideas.—(10) Words—(11) Substantives.—(12) Substitution of Cyphers.—(13—16) Nature of Substantives.—(17—19) Adjectives.—(20) Pronouns. (21) Articles.—(22, 23) Combined use of Noun, Adjective, and Article.—(24—26) Verbs.—(27—29) Substantive Verbs.—(30) Adverb. —(31) Prepositions. —(32) Conjunctions—(33) Resumé.

(8.) In the preceding chapter I have stated that external objects act upon the organs of sensation; that that action is transmitted to the sensorium; and that it is probably registered in a certain combination of nervous elements, to appear again on subsequent occasions, constituting an act of memory.

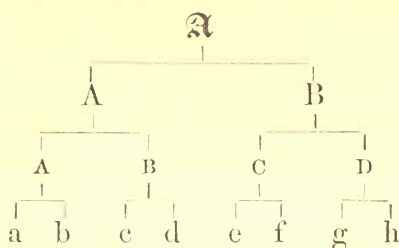
(9.) For the purpose of communicating these ideas from one person to another, or of recording them for the purpose of bringing the event again before the mind, we have recourse to various signs, sounds, or symbols, which represent various images impressed on the brain.



(10.) But from the amazing number of images which may be impressed upon the brain, the use of words becomes a complex phenomenon, because it would be impossible to assign a different word to every single image formed in the organization.

(11.) The first class of words which we employ comprises those which are termed substantives, and which, if carefully studied, will be found to include or embrace a large range of objects under one term; thus, when we speak of a man, we speak of an object which may give rise to a vast amount of images in the organization, as it comprehends white, red, and black men, good and bad men, men in health and sickness, etc.

(12.) In my last chapter I shewed that all mental images were made up of actions on a certain aggregation or combination of nervous fibres, each of which might be designated by a certain number, letter, or word. Thus we may use certain letters of the alphabet to designate certain combinations of nervous fibres. The letters indicating the combinations may be further arranged in a geometric series, as in the subjoined diagram, and it will be immediately observed, that in the first line we have one letter, in the second two, in the third four, in the fourth eight, all having relation to each other.



(13.) In assigning the substantive word to any action, we select a combination which is common to, or forms part of a great number of images, thus if a b c d form a combination which is always present when a man is represented to our senses, we may give to that combination the term *man*, or in symbolic language A, which will be found to include these letters.

(14.) It will thus be seen that generally a substantive is a part of speech given to the action on a combination of nervous elements, which are affected in common by a large class of objects, and is, therefore, in itself a very general term. The words *man*, *dog*, *ground*, *star*, may serve as an example of the noun or substantive. Grammatically a noun may be defined to be a word used for some action, real or imaginary, which has occurred in the brain. It is immaterial whether the images to which we have given the names of nouns are produced by actions through the organs of sensation, or whether

they are mere thoughts, and have no external existence, as a word of the nature of a noun may be given to any action of the sensorium.

(15.) A mere noun can convey little or no knowledge when used by itself; for instance, the word *man* used apart from any other word, either implied or understood, would, by itself, communicate no real knowledge from one person to another, as it would neither express who the man was, where he was, what he was doing, or, in fact, any other circumstance concerning him, or even whether the image to which it referred was used to signify a thought or a reality.

(16.) For the purpose of more accurately defining the noun, we add some word common to another combination of actions, or virtually we add a word, having some of the properties of a second noun, to it; but the second word so added, we term the adjective. Thus if we speak of a good man, we have defined the character of the man, or limited our observation to a man who is characterized by some quality of goodness. If A represents a man, B comprises the combinations of the actions of the brain, which we term goodness; then if we speak of A with some portion of B conjoined, we have restricted or limited our observation to the combinations of A, to which some of B are added.

(17.) It will be perceived that there is nothing peculiar or definite in either A or B, which should entitle it *per se* to the name of a noun or adjective, for either might be the noun, and either might be the adjective, and yet the effect would be very different. In the one case we should have *good man*; in the other, *manly goodness*. In these cases, the combination to which we desire to call attention is the noun, and must be accurately defined, and the word by which the extent of the noun is limited, is called the adjective.

(18.) When we use a word adjectively and couple it to a noun, the adjective implies that only a portion of the actions of the brain which led to the idea from whence the word is derived, are coupled with the noun; hence, as the amount varies, we have various degrees of the word used adjectively, as *good, better, best*. The information conveyed by an adjective, is not of that positive character which is conveyed by a substantive; and when I say a good man, I should express it by symbols, by using A for man and B—? for some unspecified amount of goodness. If I said or wished to express manly goodness, I should use B for *goodness* and A—? for *manly*.

(19.) It follows from the above remarks, that the adjective is a far less perfect part of speech, and is unable to be used for the communication of those

absolute ideas, which may be communicated by the use of the noun.

(20.) There are other classes of words which require but little comment; thus we employ pronouns to prevent the repetition of nouns. These words have no meaning in themselves, unless some noun, either expressed or implied, has preceded their use, and both grammatically and biologically they must be referred to the class of nouns.

(21.) Various questions have been raised as to the use and signification of the articles *a* and *the*. It appears to me that, biologically considered, *a* is employed to signify any one or some unknown one. The word *the* seems to have the power of limitation to some particular one or some particular class. In accurate symbolic language wherever *the* is employed, it is necessary that the additional description should be applied to the noun, to mark the individual or class to which the word *the* limits the application of the word.

(22.) By the combined use of the noun-adjective and article, we are thus enabled to give a more or less correct picture of any real or imaginary object to a second party; but it appears most especially necessary that these words should be used in the same sense by both parties, otherwise no true information is communicated.

(23.) The mere use of the noun, however, gives us by itself no real information, because a second person would require to be informed whether any word represented a mere thought or image of the imagination, or a reality; in fact whether it referred to an object which existed in all its integrity in the external world, and which produced the action upon the organs of sensation. A noun might also signify a mere abstraction of various actions.

(24.) The words used to express this important part of the idea, are termed verbs. But a verb does more than this, it signifies the relation of the thought or reality to other thoughts or realities. In fact, it marks the time of the occurrence of the thought or of the reality. Electro-biologically, we may define a verb to be a word used to signify the changes, on the sensorium of the respective portions of one image, and their relation to those of other images.

(25.) To explain this definition, it is important to remember that the brain is one large organ, on which a series of impressions are being continually made, both from the action of external agents upon the organs of sensation, as well as from the changes going on within our own frame. If a thought or reality occurs at the moment at which we are actually receiving the second impression, then we speak of the time present, and we say *It is*. Suppose

A B C D to represent primitive nervous fibrils, and w x y z to represent other nervous fibrils, if the actions on B C and x y coincided at the moment when x y was being excited, we should state that the idea derived from B C, existed at the present time, or in the language of the verb *is* or *exists*. Now if we examine the changes which are continually occurring in the mental images, we may express them in two series in the following manner:

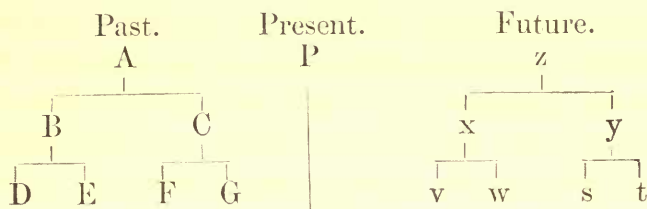
1st.	A B	A B	A B	B C	C D	A B
2nd.	l m	m n	n o	o p	q r	s t

In the above diagram we perceive that the two series of changes take place unequally. It is from this double series of ideas that we derive our notions of time, for those combinations which change least frequently, are said to occupy the longest time. For practical purposes, we select one series of changes as those of a clock, or the changes produced by the revolution of the earth as a standard, and refer all other changes to those.

(26.) Practically, when we use verbs, we do not set out accurately the changes which actually take place, but we employ words to signify time present, time past, or time to come. All verbs may be conveniently arranged into two geometric series, the one signifying time past, the second, time to come, the two being divided by a line, denoting



time present; or we may unite the three together into one series signifying all time.



(27.) But most verbs shew more than the time of the occurrence of any idea; or rather the relation of any one idea to any second idea; for if examined, they will be found to communicate some knowledge similar to that imparted by the noun; and hence these verbs might be called substantive-verbs. If I say that John sits, it not only indicates John, and his existence at the present moment, but it goes further, it shews his posture. In like manner if I say, I think it not only indicates time present, but it shews that the idea is an action of the brain, which has not necessary external existence.

(28.) Substantive-verbs communicate even a far greater range of ideas; thus if I say that John came from Brighton, the words *came from*, would not only represent that John was at Brighton and is now here, but they infer all those changes which occurred during the act of coming here. Whether we regard the motion of the carriages, the change of the view, the number of ticks of a watch, the

pulsations of the heart, the occurrence of thoughts during the journey, the changes would be almost infinite in number. All these changes it would be too long and tedious to recount, and yet they are all included in the word *came*.

(29.) A verb has essentially a reference to some change, for without it the verbs cannot be used; and even when we mark the present time, that present has relation to the past and future.

(30.) The adverb is another part of speech, which still further gives exactness to our descriptions, by limiting the scope of any observations. It is frequently used merely to assign the value or extent to an adjective or verb, as in the case of *nearly, chiefly, exceedingly, very*. Other adverbs perform the same functions to the verb as the adjective does to the noun; as in the words *prudently, softly*, when in these cases they limit the extent of the meaning of the verb, by adding to it a certain amount of the properties of prudence, softness, etc.

(31.) Prepositions are used to shew the mutual relation or position of separate ideas; as in the words *above, below, behind*. In these cases they shew the manner in which the image is received by the senses. Electro-biologically, they help in many cases to signify the particular combination which is represented to the mind; thus a man placed

upon a horse, would be represented by a different combination of nervous elements to that which would be produced by that of a man below, or behind, or before a horse. A very different idea is signified when we say that a man came from Brighton to London, from that which is communicated when we say, that a man came from London to Brighton.

(32.) Conjunctions are employed either to compress two ideas into one, or to separate one portion from a more extensive idea. In the first case, the conjunction is called copulative; in the second, disjunctive; conjunctions are, in fact, equivalent to the signs of *plus* and *minus*.

(33.) Such is a brief *resumé* of the mode of communicating impressions made on the sensorium, from one person to another. In the first place, we use a noun, which is a sort of generic term given to certain combinations common to many ideas. This general idea is then limited by the adjective, and still further by the adverb. The verb is then employed to signify the time of the occurrence of the idea, or of the changes which took place with it; and these changes are more particularised by the use of other adverbs. We, however, introduce other nouns; and their relations are more accurately detailed by prepositions and conjunctions. It is manifest that the whole system is artificial, and whilst we must

deplore its insufficiency to communicate exact ideas, yet we must, at the same time, marvel at the great and glorious results which it has been the means of effecting.

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## CHAPTER III.

### RESOLUTION OF A SENTENCE.

(34) Resolution of a Sentence.—(35, 36) Arrangement of Nouns.—(37) Notation of Naturalists and Chemists.—(38—41) Limited Nouns.—(42) Geometric Arrangement.—(43) Arrangement of the Verb.—(44) Qualified Verbs.—(45) Relation of Verbs to Substantives.—(46) Conjunctions.—(47) Notation of Sentences.—(48) Example.—(49) Value of the Notation.—(50) *Resumé*.—(51) Application.

(34.) FROM the observations which I have already made, we are now in a condition to resolve a sentence, or so to set it out, that it may appear on paper as it would have acted on the brain, had it been a reality instead of a mere description; and this resolution would not be difficult were the idea confined to the same instant of time, but a variation of time involves a succession of ideas, which it is difficult to express.

(35.) In the first place, we must arrange the substantives in their natural relations, and we must put those substantives which contain the smallest number of known combinations at the top, then we

may place successively lower all those which contain a less number of combinations. When, however, we have two substantives agreeing in all combinations but the terminal, these two should be placed on the same line. Upon this plan we should arrange the substantives, Animals, Brutes, Man, Reds, Whites, in the following manner:

			Animals A		
Brutes B				Man C	
D	E		Reds F	Whites G	

In this case we have three degrees of perfection in the specification of these words. Animals may be said to consist of A, Man of A C, Whites of A C G. Now the word Brute in this arrangement, has the same amount of definition as that of Man, and may be expressed by A B; and Reds express the same definition as Whites, and may be represented by A C F.

(36.) In this case I have only assumed one letter for the specific qualities of each noun; but if the signification of any word can possibly be disputed, then instead of one letter we must use a series of letters expressive of the qualities in such a way, that there can be no dispute upon the exact limit of the word, for until any two disputants agree precisely upon the signification of the word, any superstructure based upon it may be rendered of no effect.

When the meaning of any word is under dispute, it must be unravelled by other words, till the disputants have the same ideas for the same words.

(37.) Naturalists use, in some respects, a similar mode of describing different animals; as when they divide them into individuals, species, genera, orders, classes, etc.; and chemists more accurately note the composition of substances by symbols in an analogous manner.

(38.) When arranging substantives into their relative position, we should bear in mind any word which is appended to them to limit their signification, such as the adjective; for instance, if I speak of "a man," "a white man," "a happy white man," I have three different degrees of limitation in the three different cases.

(39.) So also with regard to the adverb joined to the adjective, the meaning is more particularised, as "a very happy white man" bears a different amount of limitation to that expressed by "a happy white man."

(40.) As, moreover, prepositions have so far an effect upon the meaning of the noun, as to limit, or particularise its signification, we must also add their value to the noun in any formal resolution of a sentence, as different significations would be

expressed by "to London," "into London," "upon London," "above London," "below London," "around London," "about London."

(41.) When two nouns are joined together by a conjunction, they collectively form one idea, as "John and Thomas." Sometimes the idea is limited by their use, as "all but Thomas," where the meaning is lessened by the conjunction. In this way the copulative conjunction is equivalent to the sign *plus*, and the disjunctive to the sign *minus*.

(42.) Perhaps, upon the whole, nouns having certain properties in common, had better be divided into the geometric series, 2, 4, 8, 16; and thus every term might be distinguished from every other term. By this arrangement, every word would signify the half of a word above it, and would conjoin the meanings of two words below it. This division appears to me well deserving the attention of naturalists, chemists, and other writers requiring the use of a large number of words. In application, partial difficulties would frequently arise, because practically odd numbers would interfere, but nevertheless, by a little management, such a division might doubtless be usefully effected.

(43.) Having considered the best mode of arranging the nouns, we are naturally led to consider



their mutual relations, together with the effect of the verb upon them. Verbs appear to signify a more complete set of actions than the noun, and in my "Instinct and Reason," I have shown that animals do not appear to have the power of appreciating their use. Some verbs simply show existence of an idea, as a thought, or a reality, at the time present. This hardly requires a sign for its designation; for it might be understood, that when we say, "John, here," that he *is* here. But any idea, be it a thought, or be it a reality not now existing, must have either existed at some former period, or may exist at any future time; and the time either present, past or future, may be represented with accuracy in a series as before described.

(44.) But the verb, besides describing the time at which the event occurred, expresses some substantive idea, then this addition must be appended to the noun to which it refers, as "John runs;" the word *runs* gives two ideas, one that John is in the act of running or performing the motion of running; the second, that this action is now taking place.

(45.) In many cases, verbs have relation to two substantives, as "John killed Thomas." In this expression, we understand that at some time past, the act of killing was done by John on Thomas, the first individual performed certain actions which caused a second set of actions to supervene on

Thomas. The verb here modifies the ideas which we derive of both nouns; and the sentence gives us the idea of at least three different states.

First,—John and Thomas both alive.

Second,—John in action—Thomas being acted upon.

Thirdly,—John alive—Thomas dead.

These series of changes or sequences, stand in relation as Cause to Effect, and in language may be rendered, that John caused the death of Thomas.

If we regard the origin of our ideas of Cause and Effect, we find that the idea of Cause is deduced from a change of matter acting upon other matter: the first change is called the Cause; the second, the Effect. Thus when we say that the fire causes the water to boil, we mean that the coal is changing into carbonic acid, which change acts upon the water and turns it to steam; the first change being the Cause; the second, the Effect. They may thus be regarded as primary and secondary changes.

(46.) The limitation of the verb by the adverb, may be treated as we limit the signification of the noun by the adjective; so, also, parts of a sentence coupled together or dissevered by conjunctions, may be treated as when used with nouns.

(47.) We are now in a condition to express any definite sentence by a series of letters, and give to it a definite form for the purpose of disputation or

study. It is absolutely necessary to set out the meaning of each word, so that its signification may be accurately defined; and hence, in some cases, it may be requisite to express a word by the combination of ideas which constitutes that word; thus if we use the word John, it may be necessary in some cases to show that John is of a certain family, and that he is a citizen, a Londoner, a white, a European, a man, an animal, an organized being.

(48.) In the resolution of a sentence we first set down the designation of the thing or person that first undergoes a change. This becomes a cause. The causality may be expressed by other letters, and designated according as we are enabled to communicate the manner of the cause. We next note the noun which is effected, and the value of the effect produced; and, finally, we designate the time at which the whole series of changes occurred.

(49.) As an example of this mode of notation, we may set down, "John and Thomas killed William." Let J stand for John, T for Thomas, C for causality, D for death, E for effect, W for William, P for the past; which electro-biologically would point to different distinct ideas having mutual relations, thus:—

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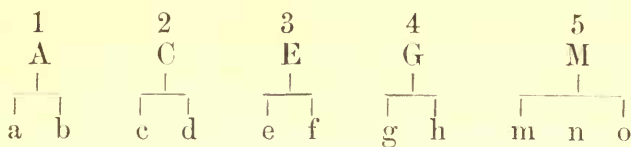
J T C    W E D    P

In the first place, John and Thomas underwent

certain changes, in consequence of which, in the second place, William underwent certain changes to death, the whole happening at some time past.

(50.) This mode of notation may, at first sight, appear more complicated than ordinary language; but if carefully studied, it will be found to afford us an artificial mode of reasoning, which, although immensely inferior to that which is in actual operation by the elaborate machine furnished us by nature, yet as far as it goes, may be conducted by fixed and immutable laws.

(51.) In reality the various changes indicated by the verb occur at different times. In any process of thought arising therefrom, the whole appears to the mind at one time. This constitutes a great difficulty in the notation of a sentence by cyphers, and can only be effected by several series of geometrical arrangements. One would be required for the description of the object changing, another for the description of the nature of the change, a third for noting the object effected, a fourth for the nature of the effect, and, lastly, we should require one series to denote the time of the whole series. This last had better be divided into three parts instead of two, to signify the past, the present, and the future; though after the first division the ratio of two may be maintained.



(52.) By the modifications of this system of notation, it is not impossible that acts of Parliament, deeds, and other exact documents may eventually be drawn; for if once the entire words of the English language were arranged in their mutual relations, this mode of writing would probably be the most exact form of language which could be adopted.

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## CHAPTER IV.

### ON INDUCTION.

(53) Induction.—(54) Nature of.—(55) Illustration.—(56) Arrangement.—(57) Classes of Induction.—(58) Absolute Inductions.—(59) Induction of Probabilities.—(60) Possible Inductions.—(61) Induction of Means.—(62) Induction of Limits.—(63) Hypothetical Induction.

(53.) I have now to treat of the method by which the mind classifies a series of facts, so as to represent them by the shortest possible method. It is a faculty of great importance to man, inasmuch as by it he is enabled to communicate a large number of facts in a few words.

(54.) The process of induction consists in finding a definite and constant connection between two or more parts of any images, or sequences of images. When, for instance, we find that every individual person dies, whether male or female, we learn a number of individual facts, or rather, we ascertain that a number of human beings have ceased to live, and taken on the various changes of death.

We then ascertain that that which we call Humanity is common to all the cases, as one part of the fact; and that that which we call Death, is common; and this constitutes the second part of the fact: hence is induced that man is mortal, or in other words, that humanity and death are invariably conjoined at one time or other.

(55.) To illustrate the nature of induction, we may take a number of combinations of nervous elements, and call them by letters. If the combination A represents that part of an idea which is possessed by all men, and W the combination given by a sense of feeling, then, if we find that where A is present W is present, we have acquired a most important information; for if A is present ten thousand times, there will W exist. If B represents that which is common to man, and we find it always conjoined with X, denoting rationality, then we know that all men are rational; so if C represents that which is common to whites, and Y denotes happiness, and D represents the peculiarities of Englishmen, and Z the characteristics of freedom, then by this series of inductions we have acquired most important knowledge.

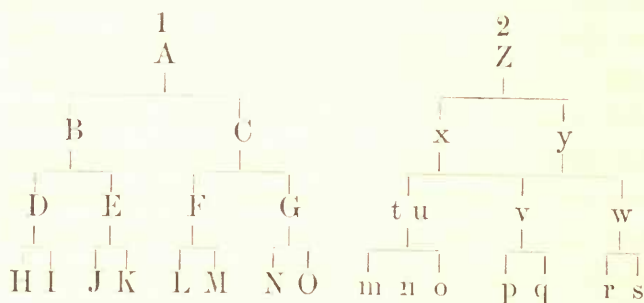
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D    C    B        A        W    X    Y    Z

But we observe, that man partakes of the properties of A B, therefore, he is W X, or is possessed

of feeling and rationality. Whites possess the characteristic of A B C, and, therefore, manifest W X Y, that is to say, they feel, are rational and happy. Lastly, Englishmen being designated by A B C D, manifest the properties of W X Y Z, or evince feeling, rationality, happiness and freedom.

(56.) The above statements may be also arranged as two geometric series, which for many causes are more convenient for study.



By this arrangement in the first series, A would stand for animal, B for man, D for whites, H for English. In the second series, it is manifest that feeling, rationality, happiness and freedom do not possess any immediate relation to each other, and therefore in the absence of any definite knowledge upon this matter, they may be arbitrarily assigned the symbols of m, n, p, r in the fourth row.

(57.) It may be useful to consider a few speci-



mens of inductions arranged in different classes, that we may the more properly estimate their value to man. For this purpose, we may consider them under six heads:—Absolute Inductions, Probable Inductions, Possible Inductions, Inductions of Means, Inductions of Limits, Hypothetical Inductions.

(58.) Of absolute inductions we find good illustrations in the properties of numbers: thus, if one be added to one, it makes two; if two be multiplied by two it makes four. These instances are so familiar, that we are apt to forget that they are inductions; but, if I state that the square of any number is equal to the sum of as many consecutive odd numbers beginning with units, as there are units in that number, as thus,  $6 \times 6 = 1 + 3 + 5 + 7 + 9 + 11$ , there probably will be but few of my readers who would be aware of the fact, and would only believe it after they had satisfied themselves upon the matter. Other examples of absolute inductions may be observed in our knowledge of the properties of geometric figures.

(59.) The next class of inductions which we have to consider, may be termed Inductions of Probabilities, because we induce a law of probability from a certain number of facts. This induction will not express to us the absolute fact in any one particular case. As an example of a probable

induction, we may instance that of the sex of children, which for our present purposes we may assume to be half male and half female according to observed experience. In reality the number of each sex is always equal. From this induction our knowledge is so far incomplete, that we cannot tell, when a child is about to be born, whether it will be male or female ; though we can calculate with tolerable certainty that out of a thousand children, five hundred will be males, five hundred females ; but we cannot tell from this knowledge which five hundred will be males and which females.

(60.) Of possible inductions, we may take in illustration the following assumed fact: amongst a thousand children one is born with six fingers, and we have no information as to the precise one which is the subject of the monstrosity. It is manifest that with this knowledge, it is possible that any one may be the subject of the disease.

(61.) The Inductions of Means is another kind of knowledge of considerable utility. This species of induction consists in ascertaining the sum of the values of a certain number of objects, when by dividing it by that number, we obtain the mean value. If we discover that four men weigh four hundred weight, then we know the mean weight of each of the four men, though we do not know in any one case the absolute weight.

(62.) The Induction of Means is much increased in value when we have the limits of variation between the different individual instances, thus a mean of 4 may be obtained between the limits of 7 and 1, 6 and 2, or 5 and 3.

(63.) There is yet one other mode of induction, which investigators frequently employ with advantage. Having a single fact carefully examined, they assume a law from it, and they examine other facts to see how far they agree or disagree with that law. This is called a Hypothetical Induction. This form of induction is most valuable if the investigator never forgets that it is a mere Hypothesis; but on the contrary, if he bends his other facts to suit the Hypothesis, then this form of induction is in the highest degree dangerous.

## CHAPTER V.

### ON DEDUCTION.

(64) Deduction.—(65) Perfect Deduction.—(66, 67) Imperfect Deduction.

(64.) As by the process of induction we are enabled to classify a large number of facts under one general rule; so by deduction we are enabled to apply this induced knowledge to any particular instance. As an example of a deduction, we may take, as an illustration, the deduction: "Man is mortal," or in electro-biological language, man A always suffers death Z. From this induction we rightly deduce that John A + B is liable to death, because John, contains A the properties of a man in his organization, or we may express the fact by symbols, that A + B is conjoined with Z.

(65.) Deductions are of two kinds, perfect and imperfect. In all cases of perfect deductions, the inference derived from the law is certain; thus, if I have twenty pounds, and add thereto twenty pounds, I may of certainty deduce that I shall then

have forty pounds, because I have previously learnt by induction that twenty and twenty make forty.

(66.) Imperfect deductions may be divided into several departments, for every deduction is imperfect in which the law which is sought to be applied is not absolute. From this cause it follows, that a deduction from a probable induction, or hypothetical induction, or an induction of means and limits when applied to any particular instance, is necessarily incomplete and unsatisfactory.

(67.) As an example of an imperfect deduction, I will assume as a law, that amongst great masses of children, half are boys half are girls. From this law it follows deductively, that of one thousand children we should probably have five hundred of each sex, but it by no means follows that out of ten children we should have five of each, for it might happen that the boys and girls are grouped together in masses of each, and, therefore, the law would not apply to very small numbers.

## CHAPTER VI.

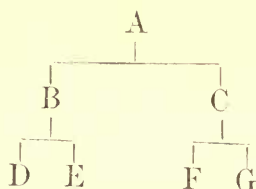
### ON THE LAWS OF THOUGHT.

(68) Laws of Thought.—(69) Properties of Symbols.—(70) Laws of Symbols.—(71) Laws of Judgment.—(72) Reason.

(68.) In former chapters I have shown how every word may be expressed by a cypher ; and I have pointed out the manner in which we can express all ideas by this mode of notation. These symbols when rightly arranged as a geometric series, have certain properties to which the laws of thought are obedient, and are most important to be studied and thoroughly understood, and it will be now my business to endeavour to explain them.

(69.) Each symbol expresses something in nature which does not stand alone, but has certain relations to other symbols. If we arrange these symbols as a geometrical series, each letter would comprise the properties of a part of a symbol above it, and those of two symbols below it, and differ in some condition from those beside it : thus let A

represent animals, B brutes, C man, D blacks, E whites.



In this case A possesses properties common to the whole symbols ; B properties common to D E.

These symbols geometrically arranged, may be called higher, lower and equal ; the higher comprise those in which the characteristics are more general, the lower those in which they are more specific, and the equal those of similar exactness of definition.

(70.) The laws of these relations constitute the entire laws of thought, and all which possibly can be learnt by the reasoning powers from any given facts.

1. Symbols denoting ideas, are limited in number, although that limitation is so enormous that no man will ever be cognizant of them all.
2. Each symbol denotes a positive action of the brain
3. A mere negation only expresses that an action on a symbol is absent.
4. A positive symbol with a negative attached, limits the signification of the positive symbol.

5. Every symbol has something in common with every other symbol.
6. Higher symbols confer their entire power upon all their lower symbols.
7. Lower symbols confer some power upon all their higher symbols.
8. Equal symbols do not affect each other.
9. A combination of symbols possesses the combined powers of each separately.
10. A symbol partially affects some of the higher symbols of its equals.
11. A symbol does not affect the lower symbols of its equals.

(71.) The act of thinking consists in comparing the relations of symbols, and that of judgment in determining whether the two sets of symbols agree or disagree. By judgment we determine Affirmation, Negation, Probability and Possibility.

1. Affirmation consists in the absolute agreement between two sets of symbols; thus, A B and A B are alike.
2. Negation, on the contrary, consists in a non-agreement between two sets of symbols; as A is not A B, A B C is not A B, C is not A B. Cases of negation resolve themselves into three classes, — first, into that which comprises those cases in which the two sets of symbols agree, as far as they go, the second



set being deficient in amount; secondly, into that in which the symbols agree up to a certain point, but the second has something added; and, lastly, into that in which there is an entire nonagreement between the symbols.

3. Probability consists in the concurrence of all the known symbols in one set of symbols with those of a second set.

Thus A B C plus, some unknown, is probably A B C D.

The degree of probability in different cases is inferred from the extent of the concurrence; or rather we may say, from the proportion of the amount of the unknown parts.

4. Possibility consists in the absence of any positive discordance between the unknown symbols of two sets.

Thus X Y plus some unknown may be possibly A B with some unknown, because both sets may consist of A B X Y.

5. An answer is absolute when the two sets compared consist of known symbols.
6. An answer is only probable or possible if a probable or possible symbol enter into either of the two sets compared.
7. An answer is only to the average, if either set of symbols contains an average statement.

(72.) I have now shortly detailed the laws of thought adapted to words and language, and

simplified by the use of symbols. For the purpose of studying these laws, the student is referred to the geometric series of symbols appended to this work; and he will readily perceive their importance and truth. In all disputes and discussions, having once referred the words employed to their proper relation in the series, the legitimate deductions can be immediately learned, and thus a far greater certainty may be given to our mode of reasoning.

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## CHAPTER VII.

### ON THE RELATIONAL AND DIFFERENTIAL MACHINES.

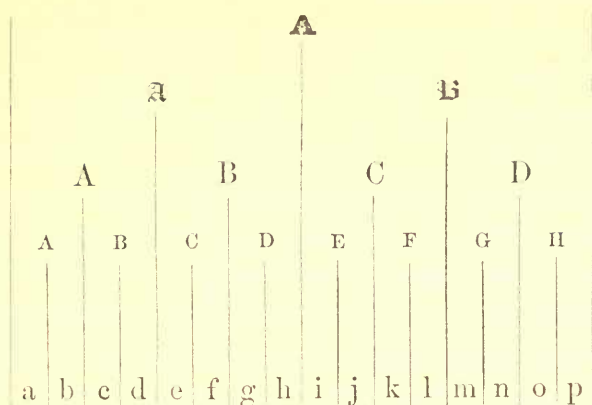
(73) Thought amenable to fixed Principles.—(74) Arrangement of Words.—(75) Application of this Arrangement.—(76) Relational Machine.—(77—81) Various Forms of Construction.—(82) Results obtainable by the Relational Machine.—(83) Resultant of Various Expressions.—(84) Power of Extensive Machine.—(85) Power of Machine analogous with process of Thought.—(86) But infinitely inferior to it.—(87) Its Use as a Calculating Machine.—(88) Deduction of Probabilities.—(89) Differential Machine.—(90) Principles of.—(91) Mechanism of.—(92) Application of.—(93) Guessing.—(94) Comparative uses of Relational and Differential Machines.—(95) Infinite perfection of the works of God.

(73.) From the laws which have been already detailed, it is apparent that thought is amenable to fixed principles. By taking advantage of a knowledge of these principles it occurred to me that mechanical contrivances might be formed which should obey similar laws, and give those results which some may have considered only obtainable by the operation of the mind itself.

(74.) In order to induce a general law from specific instances, and deduce the application of a law to a particular case by means of mechanical contrivances, we must take advantage of the geometrical arrangement of words formerly described, and denote each word by a cypher, and lastly then arrange them in such a manner that each cypher may bear its proper relation to every other cypher.

(75.) The application of the geometric arrangement of cyphers may be best represented by any contrivance, the parts of which continually divide by a hinge joint into two portions. Nothing apparently can be more simple than this arrangement; though, practically, for large series, the details are so troublesome, that it has required much more labour to bring it into a working form than I had originally anticipated, owing to the difficulty which arises from the necessity of a large number of parts being compelled to move upon the other parts of the contrivance, which is absolutely necessary to the construction of the machine.

(76) I have before me, whilst I write, seven or eight varieties of these contrivances, some of which have their fixed points at the top of the geometric series, and some at the other extremity of the same. Perhaps the construction of the latter may be illustrated by a number of lines and letters as in the annexed diagram for a series of sixteen, thus:—

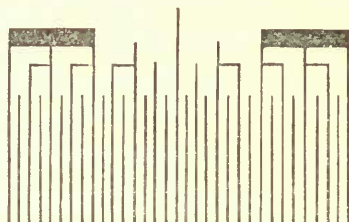


(77) In this case the fixed point of every line is at the bottom of the diagram, and each is represented as fixed upon a board. The whole is now shown as open, but it will be seen that when closed the act of opening any one of the lowest set would partially influence its corresponding cypher in the series above it. This form illustrates the principle exceedingly well, is simple in its construction, and by a proper use of readings is applicable in all cases.

(78.) Upon the whole, however, perhaps the fixed point had better be placed at the upper part of the series, and as there are some difficulties in constructing it to work as a triangle, it may be arranged to shut up as a parallelogram.

(79.) If the action of the machine is desired to illustrate by its own mechanism, the principles, then the movements must be so arranged that the

spaces of the several series must open in a corresponding way, and this may be effected by constructing it as in the annexed diagram.



If, however, the action on the cyphers is only desired, then the mechanism may be arranged by a series of bars joined together by hinges at one of their extremities, and the different cyphers may be appended in their proper places in such a way that the mechanism may be concealed. This latter plan, is perhaps one which is the most applicable for a geometric series of high power.

(80.) I have constructed machines to work by a to and fro motion, by which a great number of elements can be packed parallel; but upon the whole, an action is perhaps better represented by one bar moving upon the others. Other contrivances may be made to work upon the periphery of a circle, so that the top of the series being placed nearest the centre, opens to but a small extent for a larger range of motion between any two bars at the bottom of the series.

(81.) This kind of motion, requiring whole series of movements to move upon other movements, is a

new requisite in mechanical contrivances; or at any rate I am unacquainted with its use amongst the machines which abound in this great metropolis.

(82.) When the vast extent of a machine sufficiently large to include all words and sequences is considered, we at once observe the absolute impossibility of forming one for practical purposes, inasmuch as it would cover an area exceeding probably all London, and the very attempt to move its respective parts upon each other, would inevitably cause its own destruction. Nevertheless, those lesser machines containing but a few elements, exemplify the principles of their operation, and demonstrate those laws of induction, deduction and relation, the right use of which cannot fail to render our thoughts more accurate, and our language more precise. The best form for the readings on the machine may be illustrated as below. When the machine is shut up it will appear as printed, and by cutting it diagonally, it will give a reading when open of either None, Some, All.

			All	All	All	All	All	All
	Some	Some	Some	Some	Some	Some	Some	Some
None	None	None	None	None	None	None	None	None
A	B	C	D	E	F	G	H	I

(83.) If we examine the results which can be obtained from the use of the relational machine, we observe that an action represented by an opening at any point represents a similar action upon every other element placed below it in the series, and also a partial action of every element having relation to it at the higher part of the series, hence the value of every expression, and its relation to other expressions, can be read off.

(84.) The machine, however, can do more than this; for two or more facts, or two or more assertions, can be represented by actions in a similar manner. Like the human brain, it is competent to give the resultant of any number of propositions be they ever so numerous, and show their mutual bearings upon each other.

(85.) If the machine were sufficiently extensive to comprise every fact or principle which has been ascertained, then when any new fact is learnt it might be appended, and its bearings upon more general instances, or more particular cases, would be immediately shewn.

(86.) It is thus apparent that this mechanism gives an analogous representation of the natural process of thought, as perfectly as a human contrivance can well be expected to afford; but when we take into consideration the knowledge of the laws of



sequences which man possesses, we perceive how limited is the knowledge which it is competent to convey, when compared with that which is obtainable by the mind through the operation of the brain.

(87.) In examining the relations derivable from a knowledge of sequences, we must have recourse to that artificial system of notation described in the chapter on the resolution of a sentence. We must record the substantive changing in one geometric series; the nature of the change, in a second; the substantive acted upon, in a third; and the nature of the changes which it undergoes, in a fourth. If all the words in each division were placed in their proper relation, then any action on the machine indicates every principle which is inducible, or every fact which is deducible from the assertion. In like manner, the resultant of any number of assertions, is immediately shewn in the form of inductions or deductions. It is not necessary in practice to have a separate series for each subject, for the force of each word can be studied separately, together with its relations to other words, and their relation to the other subjects can be ascertained. Supposing that the machine could be made sufficiently extensive for all practical purposes, yet the labour of employing it would be so great, that persons would soon rely upon the abilities which it has pleased Providence to give to them, and not seek assistance from extraneous sources.

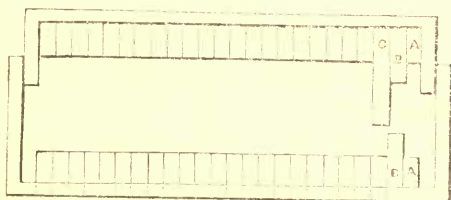
(88.) The relational machine can also be employed, to a slight extent, as either an addition, subtraction, or multiplication machine, with all the advantages attached to the use of the functions of the geometric series. To all who understand the use of logarithms, this must be sufficiently apparent, without troubling my readers with a further description; more especially, as it is never likely to be practically employed for such operations.

(89.) The relational machine may be so constructed, that when one of the higher symbols is exemplified upon it by an action to an unknown extent, as in the general assertion of *some*, the deductions in the lower series will exemplify the uncertainty as to the particular ones which are effected; thus if we know that some men are short and some tall, then in the lower readings we shall find that it is impossible to indicate from that general principle, which particular ones are short and which are tall.

(90.) Not only can we take advantage of the laws of induction and deduction, and exemplify them by mechanism, but we can also in the same way, exemplify the laws of judgment by pieces of mechanism of a different description, which may be termed the Differential Machines.

(91.) In estimating the differences between any

two assertions by artificial contrivances, it is necessary to have some mechanism to represent each assertion. For this purpose we may take a wire or pin, and divide it by spaces, represented by certain symbols. Opposite to each symbol, which must represent some word or fact, we must have the means of noting whether the character of the subject is absolutely known, or unknown, by using some appendage of two different dimensions (A B, fig. 1). By this contrivance, we can accurately set out one side of the case. Opposed to this, we must use a second pin, with appendages competent to represent by three different sizes, A B C, either similarity, dissimilarity or unknown; then by bringing the two series together, an answer as to its actual, probable, possible, or negative concurrence may be obtained.



(92.) For instance, if in a definite set of symbols the value of each is known, each would be represented by a space of one. If, on the other side, the value of each was similarly represented, then the two might shut together in the space of two, and the reading would be "Yes." If on either side

some of the values of the cypher or the word were unknown, then the two when brought together, would occupy the space of three, and the reading would be "Probable"; but, if for any one cypher the value on both sides was unknown, the space occupied would be four, and the reading given would be "Possibly." Lastly, if on the two sides, any two symbols disagreed, that want of accordance would be represented by a contrivance occupying the bulk of four on the second side, and when brought together the amount would be five, for which the reading of "No" would be given.

(93.) By the differential machine it would be possible on one side to arrange all the facts or principles which should direct a judgment on a given point, by which means, when specific facts were registered on the opposite side, the concurrence, non-concurrence, probability, or possibility would be immediately shown. Perhaps this might be beneficially brought into use by those who use fixed and unchangeable creeds; for if they be arranged correctly then any deviation from them would be immediately registered. It must be apparent that such a machine would not estimate the quality of the creed, but only show whether any new creed, or portion of creed, coincided or not with the former creed. For whether the creed inferred a belief in the true God, in Mohammed, in ibises, crocodiles, or saints, in the power of the Virgin, or

winking pictures of her, or the qualities of relics, or the virtues of images, or in the parties' own inspiration, the effect would be the same, as these beliefs being assumed as true, the truth of that which is compared with them is ascertained according to them. There are many other cases where such a contrivance might be beneficially employed; for whenever passion or powerful feeling is likely to interfere with a sober and correct judgment, then the examination of each part separately is likely to be properly used when the mechanical answering upon the whole case will be, although immediately performed by a human contrivance, according to those principles which regulate the action of the brain in such circumstances.

(94.) Nothing can show more usefully than this machine, the futility of guessing at any decision without any or sufficient information upon which to form an opinion; for if, at random, certain actions be rendered on both sides of the machine, then the almost certain impossibility of ever arriving at a true concordance will be speedily found upon trial. What is true of this piece of mechanism is true of the mind, which sufficiently teaches how slow we should be to pass an opinion without a knowledge of all the facts which bear upon the question.



(95.) By using the relational and differential machines together, we are enabled to obtain the

bearing of any facts, or to arrive at any conclusion to which the mind by itself is competent. From any definite number of premises the correct answer may be obtained, by a process imitating, as far as possible, the natural process of thought.

(96.) By the natural powers of thought the mind also possesses a spontaneity, a power by which bygone impressions appear, constituting an act of memory. These the mind treats according to all the laws impressed on the brain, and moulds them into one harmonious whole to constitute an act of imagination. This property, ever active in the fertile minds of our dramatic and novelist writers, is never exercised without due regard to the experiences which have been afforded of the sequences of events. The mere conception of an idea would be useless unless its relation to other ideas and other events was fully shown, and the exercise of the faculties of remembering, combining, and comparing ideas, is amply shown in man, and indicates a power of adaptation in his cerebral organization as given by Nature, infinitely superior to any human contrivance however ingenious. We thus perceive, that whether we study the mechanical arrangements of the bones, the optical structure of the eye, the hydrostatic apparatus for the circulation of the blood, the acoustic arrangements for hearing, the mechanism of muscular motion, the generation of force, or that physical structure

which is the instrument of the mind, we are equally astounded at the infinite perfection of their design. This cannot fail to show to man his utter insignificance in his inventive skill, as displayed in his mechanical contrivances, when contrasted with the wonderful example of creative power which his own beautiful and perfect organization affords, and must make him deeply feel the infinite goodness and power of God.

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## CHAPTER VIII.

### ADAPTATION OF PROCESS OF THOUGHT TO ALGEBRAIC FORMULÆ.

(97). Syllogism.—(98). Algebraic Formulæ.

(97). The laws regulating the natural process of thought, can not only be exemplified by mechanical contrivances, but can also be adapted to algebraic formulæ. In logical works the notation which is used is remarkable for its extraordinary vagueness of character. Thus logicians set out the syllogism—

all men die .....	every Y is X	
all men belong to the class of rational beings .....	}	every Y is Z
therefore some rational beings die .....		
	}	therefore some Z's are X's.

Upon this plan logicians exemplify what they call logical deductions, but the most casual examination will sufficiently explain why no man of sense ever employs logical ambiguities, for how possibly according to the ordinary use of symbols and words can every Y be both X and Z, and yet only some Z's be X's, for the word *is* or *be* denotes



equality, coincidence, sameness, and does not admit of limitation. In the logical system the word is used in two senses.

(98). According to the electro-biological view, the assertion, All men die, may be rendered  $A$  (assertion) =  $Y$  man +  $X$ , mortality; that is, the words man and mortality are always conjoined. According to the second assertion, we find that  $Y = Z$  rational beings— $U$  something else, which is unknown, from which we find that  $Y + X = (Z + U) + X$  from which we know that man being mortal, some organised beings are mortal. By conducting our formulæ upon this plan, every proposition can be solved according to those true principles which men who are reputed to have common sense, conduct their operations, for no matter how many assertions are given, satisfactory conclusions based upon them can be obtained.

(99). In the comparison of two assertions, ordinary modes of applying symbols can be adopted, for according to the principles which we have developed, when the assertions are unravelled into their component parts, if every part on both sides is identical, the assertion is affirmative; if at any one part a difference exists, the assertion differs; if in any one part its nature is unknown, then the coincidence is only probable; and lastly, if at any one part the nature on both sides is unknown, then the coincidence is only possible.

## CHAPTER IX.

### VALUE OF THE PRONOUN *I*.

(100). Natural Process of Thought.—(101). Value of *I* —(102). Suppression of Opinion.—(103). Effect of.—(104). Practical Application.

(100). In the human brain impressions from the external world are continually being received, are there registered, and remain to produce their influence on the comparison between new and bygone knowledge. As far as the mechanism of the brain exceeds that of any human contrivance, so is the result of the proper application of the mind more trustworthy than the artificial contrivances of reasoning by words, cyphers, or mechanical inventions.

(101). From this cause great respect is paid to any trustworthy person, when he boldly declares that he himself believes that any opinion which he promulgates is true. In writings, therefore, nothing can exceed the value and force of the word *I*, either implied or used; and although there are

not found wanting amongst the lower class of literary scribblers, persons who scoff at the Pronoun, and attempt to ridicule its use by recounting the number of times per page it occurs; yet its more abundant employment would have saved the world from much sophistry, deceit, and falsehood.

(102). Almost all untrue statements are based upon arguments by words, and the person who writes never gives his opinion unequivocally. His arguments in words throw the responsibility of the conclusion on his readers, from the facts which he has recorded; and there is nothing to show how many other facts or parts of facts he has suppressed. But if he makes an assertion of his own belief, his readers have the result of the natural process of thought, if he be but trustworthy.

(103). By avoiding the use of the word *I*, a newspaper editor in America actually conducted two journals of totally opposite politics at the same time. In both cases he shewed certain arguments, and the conclusion legitimately deducible from the premises; but he took care not to include the little word *I*, or in other words, to shew the belief which his own natural process of thought led him to adopt.

(104). In all professional subjects the opinion of the professional person should be obtained. If you

judge from a long report, you have a result of far less value than if you judge from his own opinion of the case. In the case of a lawyer, he should distinctly give his opinion upon the whole facts of the case, so a medical man should be expected to state a definite opinion from all the materials which he can collect upon the subject. In giving this opinion, a result is obtained which has been derived from the mind, the immediate work of God. In setting out an argument by words or symbols, a result is obtained by a process of mechanism devised by man.

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## CHAPTER X.

### ON EVIDENCE AND TESTIMONY.

(105) Trials.—(106) Theoretical Perfection of.—(107) Verdict generally only one of probability.—(108) Example.—(109) Remarks.—(110) Use of the Jury.—(111) Civil Cases.—(112) The use of Words.—(113) Defendant.—(114) Contradictory Testimony.—(115) Imperfection of Trials.

(105.) Trials are employed to determine the truth of an accusation against a certain person or persons, that is, whether he or they at a certain place did something which constituted a cause which produced an effect, the whole occurrence having taken place between certain times. This constitutes the charge, for instance, "John, at No. 1, Peaceful Cottage, beat James, last Monday, at 10 o'clock." For the purpose of ascertaining whether the offence was really committed, a number of witnesses are called, and the evidence which they each received, through the medium of their senses, is recorded. If the images received upon the sensorium of the witnesses, according to their statements, correspond entirely with the images which

such a charge should have produced, the guilt of the party is said to be proved by the concurrence.

(106.) In carrying this process to the very utmost possible perfection to which the system is capable, every word should be so described that no possibility of wrong interpretation could occur. Then and only till then can the statements of the witnesses, when they express that which they receive upon the brain by symbols or words, be relied upon, and no error be likely to occur from ambiguity. When the sets of words or symbols derived from the witnesses, are compared with the words or symbols constituting the charge, and are found to exactly concur, then a mere piece of mechanism would be sufficient to show the guilt of the party.

(107.) But we rarely can procure the evidence of witnesses to prove charges in serious offences. The eye of man is shunned at such periods, and thus no one sees the deed, and the entire evidence is scarcely ever procured. In these cases, the guilt of the party must of necessity be one of probability or possibility as there cannot be an absolute concurrence between the symbols of the evidence and the symbols of the charge. Nevertheless, upon that possibility the law has wisely ordained that criminals should be convicted, and expiate their crimes by the highest punishment.

(108.) Suppose, for instance, "John is charged with killing Thomas with a knife, at 1, Miniver Place, at 2 o'clock on Monday." In this case, evidence might be adduced that John was there at that time, and that John's knife actually killed Thomas. Now, in this instance, the mode of the act of killing would not be proved but from the concurrence in all other particulars, and the total want of disagreement. John is probably guilty, and the jury would doubtless return such a verdict.

(109.) This verdict, however, is only one of high probability, and we must not forget that James, of whom no evidence was given, and against whom no charge was made, might have taken the knife from John's pocket, killed Thomas, and then put the knife back again, totally unknown to John. There can be no question but that in the annals of English jurisprudence, notwithstanding all its care, innocent persons have fallen victims from probable or possible guilt having been confounded with actual guilt.

(110.) The laws of affirmation, negation, possibility and probability, might be turned with good account to prevent this serious mischief. The accusation might be clearly set out; the evidence of the witnesses might be taken before the jury, who are manifestly the proper persons to assign a right word or symbol to the impression which the

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witnesses received of the event in question. Having arranged these symbols, one by one, opposite the corresponding symbols of the accusation, a mere engine would describe the possible, probable or actual guilt of the person accused.

(111.) Although I have assumed a criminal case for the purpose of my argument, yet the same reasoning would hold good in every civil case. One man sustains a damage at the hands of a second; the charge is set out, the witnesses give their testimony, and the question of identity between the charge and testimony is one which may be determined by mechanical contrivances when the words in the two instances are accurately set out.

(112.) In every case the intervention of the jury is necessary to assign a word to express that which the witness describes, because it would be impossible to obtain witnesses who shall be enabled to declare the particular nervous fibres which were excited when the event occurred. Moreover, the examination of every word with such minuteness, would be too tedious, though it might admit of minute investigation. The meaning of every important word should be fully unravelled in every instance.

(113.) When the defendant answers a charge,



he should, if it be unfounded, admit every circumstance which is true, and deny only the circumstances which are false. By this proceeding, the attention of the jury is likely to be concentrated upon the immediate point in dispute, and thus be enabled carefully to estimate the value of the testimony adduced. By this course, the accused destroys the apparent effect of that high probability which is likely to be produced by an extensive concurrence between the charge and the evidence.

(114.) In most cases of testimony the assertions of all the witnesses do not agree. Some give evidence of one kind, some of the opposite, so that the evidence upon the same point is contradictory. In these cases, the laws of induction and deduction are applied by the jury, to judge of the value of the testimony, and that which affords most probability, or that which most coincides with former knowledge, is received.

(115.) We thus perceive how imperfect, at best, are our conclusions, even when based upon the most approved evidence. We cannot fail to observe, that however carefully a jury may investigate a case, however unbiassed and unprejudiced they may be, yet, nevertheless, their verdict, in a majority of cases, can only be considered as

proving the probability or possibility of the guilt of any person. In every instance the result is obtained by the artificial means afforded by words and language, and we should never forget<sup>1</sup> that wherever words are employed, there errors may creep in.

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## CHAPTER XI.

### ON LOGIC OR THE ART OF QUIBBLING.

(116). Logic applicable to Quibbling.—(117, 118). Quibbles by Puns.—(119). By Qualified Nouns.—(120). By Variations in Number.—(121). By the Question involving Two Answers. (122.) By Constitution of Words.—(123). By the Verb.—(124). By General Principles, with Exceptions.—(125). By Two Words for the same Thing.—(126). By Cause and Effect.—(127). By using Words contrary to well-known Principles.—(128). By Action conjoined with the use of Words.—(129). By Variations of Emphasis.—(130.) By Exalting a Probability.—(131). By Circular Reasoning.—(132). By a Question involving a False Premiss.—(133). By reasoning upon that which may be known.—(134). By changing the Word for the same thing.—(135). By a Variation of Punctuation.—(136). By begging the Question.—(137, 142). Other forms of Quibbling.—(142). Conclusion.

(116). Logic has now been the means for so many ages employed by mankind for quibbling, deceiving, and leading to wrong conclusions, that we cannot do better than restrain its application to the same derogatory purposes, and instead of shewing how, by extraordinary acumen and a high

exercise of mental power, it may serve to a good object, we shall at once describe the usual methods by which it serves for a contrary purpose.

(117). For proving what is false from any given premiss, logic is extremely convenient, as the system does not note with sufficient accuracy the signification of various words, and their mutual relations, unless, indeed, we except any very gross ambiguity in the middle term. A pun consists of good reasoning upon words having one sound or spelling, but two senses. By the natural process of thought, unless the individual is, indeed, exceedingly obtuse, the mind, as soon as the conclusion is brought before it, perceives the joke, and the auditor laughs at the deception. Example, "John, as you are light you can illuminate this passage."

(118). Puns, however, are such glaring cases of using apparently the same word in different senses, that a deception could very seldom be practised by them, yet in a less degree errors may certainly arise in that manner.

(119). One great and frequent deception which can be effected under the logical system, is by using a noun in one term, and a qualified noun in a second. But to be successful, the qualification must not be apparent, it must be under-

stood. If I say "I had a bird for dinner," then the qualification "cooked" is understood. The further removed this qualification can be placed from the noun in any argument, and the smaller it is in amount, the more successful is the quibble likely to be. A humorous story is quoted by Professor De Morgan, which is a good example of a transparent quibble of this character. "A servant who was roasting a stork for his master, was prevailed upon by his sweetheart to cut off a leg for her to eat. When the bird came upon table, the master desired to know what was become of the other leg. The man answered, that storks had never more than one leg. The master, very angry, but determined to strike his servant dumb before he punished him, took him the next day into the fields, where they saw storks standing, each on one leg, as storks do. The servant turned triumphantly to his master, on which the latter shouted, and the birds put down their other legs and flew away." "Ah, sir," said the servant, "you did not shout to the stork at dinner yesterday; if you had done so, he would have shewn his other leg too."

(120). Another common mode of deception for those who admire that course, is to link two sets of things together, and thus it has happened that when a statement has been made true in all particulars but on some trifling point, a total denial has been given to the whole, and then the auditor was

allowed to infer that the whole was not true. Example.:—"Are there not persons involved." Answer:—"No " It was afterwards discovered that there was one person.

(121). The converse method is frequently employed by unscrupulous counsel in their cross-examination of witnesses, to make a fact appear to the jury contrary to what it really is. For this purpose they ask a question as to a qualified noun, the answer to the noun being negative, the qualification positive, or *vice versa*. For this mode of quibbling, the qualification should be as much concealed as possible. The object of this quibble is so to put a question that a direct answer either way is both partially true and partially false, thus:—"Did you go there soon?" Now either Yes or No would be partially true and partially false, because "I went there, but not soon."

(122). The value of logic to deceive or give a wrong inference, by extending or limiting the sense of a word, cannot be overrated. It is so perfect, that probably no well-instructed logician would fail to evolve an argument, and give a totally different conclusion from that which is correct. On all these occasions the error should be thrown over as many words as possible, that it would become a matter of much labour to discover its exact locality.

(123). The Verb is a word upon which the quibble may be turned. In the first place, the substantive character contained in the verb may be altered a little by attenuation or amplification, with precisely the same results as though the quibble had been made by the Noun. The quibble may be made by extending or limiting the signification of the time so little that it is scarcely noticeable, and yet the meaning may be greatly altered. At times even the effect which the Verb has upon the meaning of the Nouns to which it appertains, may be in like manner altered. Whenever we can add or subtract ever so little from the true signification, the meaning may be entirely changed.

(124). A common form of quibble amongst dishonest men is to give an answer inferring a premiss which renders a supposed fact impossible; for instance, when Dr. Wiseman was accused of taking an oath to persecute the very Protestants who tolerated him, he answered to the effect that Cardinals were not required to take the oath; and to this day nobody knows whether he took the oath or not. The quibble consists in the value of the proposition—"Cardinals are not required to take the oath," for it is possible that the general principle may be limited by an exceptional case, understood but not expressed.

(125). There is a mode of practising mendacity

which would not be immediately apparent to honourable men, who would shun such a course as derogatory to human nature, and would, therefore, never suspect its being practised. It consists in using two words to signify the same person or thing, one being used in one case, the second in the other, and then the assertion which is made of one is denied of the other. When Wiseman was reviled for the influence which some priest exerted on the mind of an old man to cut off the entire fortune from his own children to bestow it on Dr. Wiseman, he replied that the statement was false, for that his name was not mentioned in the will. The son rejoined "No, but the name of the Vicar Apostolic was," the Vicar Apostolic and Dr. Wiseman being at one time the same person. In the same reply of Wiseman, one of the most celebrated quibbles which history can afford, was also manifested, for he stated that the son was living upon the property, and enjoying it, instead of its having been bequeathed away; but judge the astonishment of the public, when the son declared that he had but a life-interest, and that the kindest of fathers, when above eighty years of age, had been induced to give the whole to the papal church. We can hardly wonder why it is almost universally felt that papists are not believable on oath, when such terrible examples of moral turpitude as the *strained* signification of a word for the purpose of suppressing the truth, and conveying an untruth would appear to



be considered by them as extremely clever and laudable.

(126). A telling mode of quibbling is much used by quacks. In this case the quibble is thrown upon causality. They enter into an elaborate argument to prove truly that something undergoes a change, and thus may become a cause; they repeat the argument upon the something which changes and becomes an effect; but the cause and effect have no manner or kind of relation, the cause being the cause of another effect, and the effect the result of another cause.

(127). There is a form of quibbling which is powerful in scurrilous writings; for instance, we may give a man credit for the love of some virtuous action, in doing something which is manifestly not virtuous, and hence, from the result, infer the contrary to that which is expressed. As if we said that A B, no doubt from a love of honesty, religion and high principle, keeps the money left to the orphan and fatherless, applies the wealth bequeathed to the friends for his own purposes, seizes upon all which he can obtain by law, and not by equity, and makes a merit of giving to charities money which morally belongs to others. The mind is first led to anticipate honesty and high principle; but in the end it discovers moral delinquencies, which it shudders to contemplate, and the villany

of the action is inferred by premises not given but intrinsically belonging to it.

(128). A quibble is sometimes practised by some action, having a definite signification, being used in addition to the words spoken; thus, if a person asks a pew-opener to shew him into a seat, and at the same time rattles the money in his pocket, the pew-opener would certainly infer that he was to receive some reward for the performance of his duties; but if the visitor on gaining a seat, took his hand out again without bestowing the gratuity, doubtless the official would be so much astonished, that his devotions for that service would be materially interfered with.

(129). The meaning of a word may be totally altered by mere change of emphasis, and hence this plan is often used for quibbling. The words from the Bible, "Saddle me an ass, and they saddled him," may be totally varied in their signification by a change of emphasis on the word *him*.

(130.) A fallacy which is frequently employed, is, to allow a question of high probability to be inferred as a certainty, and conversely, a question of certainty to be inferred as only one of high probability; as if we said, that John was found guilty of murder, therefore his innocence is impossible. So, also, a possible supposition may be extended into a

reality, and many men are ruined by investing money in concerns which are only *possibly* good. A mean in the same way may be used without reference to the variation of the limits; thus a man might be drowned in a river whose mean depth was only one inch, because occasionally it may be six feet deep. In these and many other similar ways do men too often deceive and sometimes ruin their fellow-men.

(131.) In conversation, persons frequently take two sets of words, each having the same meaning, and argue that one is true because the other is, when, in reality, neither is true. Thus "John is a tall man, because he is a person of considerable height. By this mode of quibbling the mind is thrown off from the manner in which information was got of his height, and the probable value of that assertion. This is called Circular Quibbling.

(132.) People are often thrown off their guard by being asked a reason for that which is not true, and by which they are led to infer that a falsity is true. Example, "How can Lead be turned to Gold." To answer the question centuries were spent in attempting the conversion. The question involves the understood premiss, that lead is convertible into gold.

(133.) Conversely, persons are deceived by

reasoning upon that which can be reduced to a matter of fact. Lady Morgan states, that the celebrated Denon and Champollion, told her that they saw, in Cufic characters, "There is but one God, and Mahomet is his Prophet," engraved on the chair of St. Peter. The Cardinal, to whose fertile ingenuity, and varied talents I am so much indebted for cases illustrative of many kinds of disreputable quibble, answers the assertion by long and learned arguments, coupled with personal abuse. The quibble consists in drawing off attention from the only true mode of settling the question, which Lady Morgan has already pointed out, namely, by showing the chair.

(134.) One of the most certain of all forms of quibbling is to describe the same thing by a totally different word. In this way the greater part of Paganism has been handed down, under the much-abused name of Christianity, by and for the benefit of a wily priesthood. This greatest scourge of the human race has been thus enabled for centuries not only to promulgate blasphemous fables, and carry on their selfish practices, but even to make their poor deluded followers believe that they are the only true Christians. When we find that a weak and priest-ridden peer is wheedled into acquiescence in the sacrifice of a niece, by frustrating the objects of the Most High in sending her into the world, to gratify the greedy avarice of a

degenerate Church and venal priesthood, we can only rejoice that the iniquitous act sullies not the purity of the true Christian faith, but only further opens the eyes of the public to demonstrate the horrors of Pagan imposture and superstition. After twenty millions have been spent in emancipating the African heathen, it is strange that ladies in a Christian country should be permitted to be consigned to dungeons, and in some cases cruelly tortured, to gratify the avarice and prurience of a heartless priest. It would be well if the Earl would, by embracing the doctrines of Christ, put an end to the hereditary curse which overhangs his title, of exclusively fostering the Plague-Spot of Humanity.

(135.) By a variation in punctuation a complete subversion of the meaning of words may be produced. At various times I have met with curious exemplifications of the possible mode of quibbling, by a variation in the punctuation, and once a person actually told me that he never punctuated his letters, that he might make them read in various ways if that course should be required.

(136.) Sometimes quibbles turn upon assuming a conclusion as proved, which is termed begging the question ; and at other times the mind is distracted by a second person answering away from the main point, which is an evasion of the question.

By skilful quibblers both these modes may be rendered sufficiently effective to deceive others.

(137). There is a form of quibble much practised by senators and other great men. They give a right conclusion, but conceal, increase, or alter, the whole or a part of the premises from which the conclusion has been drawn. I admit the necessity of keeping back facts at certain times, but fearing the danger of any kind of quibble, it appears to me, that a man in power should have the option of submitting or concealing the facts, rather than that he should be compelled to resort to any form of untruth whatsoever, even for the benefit of the state.

(138). By introducing hypothetical facts amongst direct assertions, an inference may be given to the mind of a second party that such fact exists, or that there are good reasons to believe the possibility of the fact. Example:—He is a good lawyer, a clever man, a person of great industry and ability, and will be admirably adapted for your purpose *if he is honest*. By this quibble the man's honesty is questioned.

(139). There is a quibble used by controversial writers, as they frequently contrive to throw the quibble upon the value of an authority; thus, the author must be wrong because Hunter says differ-

ently. This assertion involves the false premiss, that everything which Hunter says is right.

(140). It not unfrequently happens that persons quibble by denying the desire to do a particular act while they are actually engaged upon it: thus — I do not wish to be guilty of the bad taste of praising my own piece of sculpture; but yet, when I examine the charming proportion of its parts, and the beauty of its finish, truth compels me to declare that there never was any piece of work equal to it.

(141). The multitudinous quibble is generally practised by our transatlantic brethren in the formation of companies. They state a general fact in a prospectus, and then support it by various statements in newspapers, letters, etc., so that they get a combination of statements all tending to one conclusion. The popish priests use similar means to entrap victims into those dens of iniquity, called “Religious Houses;” and it is practically found that very few persons have mental power sufficient to withstand the combined and reiterated assertions of a number of people all varying in their statement, but yet tending to the same end.

(142). A rather refined quibble is occasionally practised by taking advantage of some abnormal state of the second party, when he is not likely to



see things in their true light. It is said, that by taking advantage of a fatigued state of body after the gaieties and late hours of a London season, the niece of the Earl of Shrewsbury was nearly entombed in a convent, and despoiled of her fortune of £80,000. The talented papal quibblers also take advantage of depressed states from illness, anxiety, the loss of relations, the better to act upon those whom they have marked for their purposes. I cannot learn, either at the Bank or elsewhere, that any other sect or denomination but the Papists use these quibbles as a regular system.

(143). I have now shewn how man can deceive his fellow creatures by the use of that artificial system of words and language, the power to use which has alone been bestowed by Providence upon human beings. To debase this excellent gift, is not only directly contrary to God's word and to human laws; but experience shews that the perpetrator of the offence invariably himself suffers from any attempt to deceive his fellows, and that it may be regarded as one of the highest crimes of social life. As a rule, man will not hesitate to quibble by words, when he would hesitate to tell a direct falsehood. To improve our system, let every quibble be considered as a falsehood, and the perpetrator treated accordingly. No matter how voluminous an argument may be—no matter how the truth or falsehood may be involved, a man may always be put upon his



veracity in any statement he may make, by asking him, "Do you of your conscience believe your assertion to be correct and calculated to lead to a right inference?" By this question you throw the difficulty from the work of man in his mechanism of words, to that work of God from which emanates the mind. In obedience to this recommendation, I do declare, that this work, and my treatises on which it is founded, contain, to the best of my belief, correct and true deductions from all the facts which I have been able to collect upon the structure and the mode of arrangement of the nervous system on the one hand, and the observed functions on the other; and I feel assured that the whole system is one fairly based upon the observation of nature.

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# A CONDENSED CATALOGUE OF CHEMICAL AND OTHER APPARATUS, FOR ILLUSTRATING THE VARIOUS BRANCHES OF NATURAL PHILOSOPHY;

MANUFACTURED AND SOLD BY

**HORNE, THORNTHWAITE, AND WOOD,**

Opticians, and Philosophical Instrument Makers to the Hon. Corporation of the City of  
London Schools, British and Foreign School Society, &c., &c.

123, NEWGATE STREET, LONDON.

## CHEMICAL APPARATUS.

	s.	d.	£	s.	d.
ALEMBICS, Glass, $\frac{1}{4}$ pint to 2 qts. . . . .	5	0	to	1	0
Alembics, Earthen . . . . .	from	3			
Argand Lamps . . . . .	each	6		0	8
Ditto ditto, with double Concentric Wick . . . . .				0	15
Alkalimeters . . . . .	each			0	6
Pieces of Fragments for the Blowpipe . . . . .	per set			0	2
Bladder, with Ferrule . . . . .		2	to	0	3
Ditto, with Stop Cock . . . . .		5	to	0	6
Bars of Copper, Zinc, and Iron . . . . .	from	0			
Brass Tripod Stands . . . . .		6		0	1
Black Lead and Porcelain Tubes for Furnaces . . . . .	from	1			
Bent Tubes of every description made to order . . . . .		0		2	6
Brass Pipe for blowing Gas Bubbles . . . . .	from	0			
Blowpipes, common . . . . .		6			
Ditto, Pepy's . . . . .		6			
Ditto, Wollaston's . . . . .		6			
Ditto, Black's . . . . .	from	1		0	2
Ditto, Bergman's . . . . .		5			
Ditto, Gurney's Oxy-Hydrogen . . . . .				2	2
Ditto, Self-Acting Spirit, Brass . . . . .				1	10
Ditto, ditto, Tin . . . . .		6			
Ditto, Bellows, with Table, &c. . . . .	from	63		6	6
Ditto, Hemming's Jet . . . . .		0		0	9
Ditto, Tilley's Hydraulic . . . . .		21	0	1	5
Ditto, ditto, very superior . . . . .				2	2
Balloons . . . . .	each from	1		0	10

		s. d.	£ s. d.	
		s. d.	£ s. d.	
Philosophical Apparatus, &c., sold by HORNE, THORNTWHAITE, & WOOD, 123, Newgate Street, London.	Bell Air Jars, Glass, with ground stoppers, for collecting the gases	each 2s. 6d.,	3 3	0 4 0
	Ditto ditto, mounted with Brass Caps and Screws, for the reception of Air Cocks and other Apparatus, each, pints 4s., quarts, 5s.			
	Ditto, graduated	from	3 6	
	Cut Air Jars, per nest of 6			0 8 6
	Ditto ditto, larger			0 10 0
	Crucibles, Cast Iron	each	0 6	to 0 3 0
	Ditto, Hessian and English	in nests	0 3	to 0 1 0
	Chemical Scales	from	5 6	
	Ditto ditto, with Decimal Weights	from	63 0	
	Chafing Dishes	each from	12 0	
	Crucible Tongs	from	1 6	
	Covered Copper Wire	per lb.	4 0	to 0 12 0
	Copper Basins	from	1 9	
	Copper Sand Baths	from	2 0	
	Iron ditto	from	7 0	
	Cubic Inch Tubes	each		0 5 0
	Caoutchouc, in sheets	each	1 0	
	Ditto Tubing	per ft. from	1 6	
	Ditto Varnish	per oz.	0 4	
	Copper Stills, with Furnace, Tub, &c., complete	from		5 5 0
	Cuff's Scale of Chemical Equivalents		5 6	to 0 6 6
	Cement for attaching Brass Work to Glass Apparatus	per lb.		0 2 0
	Cryophorus	each		0 4 0
	Bottles, stoppered, of all dimensions.			
	Ditto ditto, with Glass Caps, for Acids, Volatile Fluids, &c.	from	2 0	
	Ditto, Woulfe's	each pint	2 6	qt. 0 3 6
	Ditto, Specific Gravity	each		0 1 6
	Ditto, Specific Gravity, stoppered, and graduated to 1000 grains, in Tin Case, with Counterpoise Weight			0 8 6
	Connecting Pieces and Ferrules, Brass	each		0 0 10
	Candle Bombs	per doz.		0 0 4
	Decimal Weights, complete set of, in Mahogany Box			1 10 0
	Deflagrating Ladles	each		0 0 6
	Deflagrating Ladle and Air-tight Collar		2 6	0 3 6
	Davy's Safety Lamp	each		0 10 6
	Dropping Tubes		0 4	0 0 6
	Elegant and very useful Apparatus, for Experiments with the mixed Gases upon Lime			1 0 0
	Eudiometers, Ure's			0 8 6
	Evaporating Dishes of real Wedgwood-ware, not liable to crack or stain—			
		s. d.		s. d.
	2 inch over	each 0 4	7 inch over	each 1 8
	3 ditto	0 6	8 ditto	2 0
	4 ditto	0 9	9 ditto	2 6
	5 ditto	1 0	10 ditto	3 6
	6 ditto	1 4	11 ditto	4 0
			12 ditto	5 0
	Flasks, $\frac{1}{4}$ pint			0 5
	Ditto, $\frac{1}{2}$ pint			0 9
	Ditto, pint			0 10
	Ditto, quart			1 3
	Ditto, with bent Tubes for generating Gases		5 0	to 0 8 6
	Filtering Paper	per lb.		0 1 4
	Funnels, Glass and Porcelain	from	0 6	
	Ditto, long-necked, bent Glass	"	2 0	to 0 3 6
	Furnaces, Black Lead	"	10 6	to 3 3 0
	Ditto, French	"	21 0	to 1 10 0
	Ditto, Horne and Co's improved Portable, combining the ordinary Chemical Furnace, with the Reverberatory and Blast, complete, with Sand-bath, &c.	from £6	6	to 12 12 0
	Ditto, Round			3 3 0
	Ditto, Dr. Black's			4 15 0

			s. d.	£ s. d.	
Furnace Stoves, for experimental purposes, made to order.					
Fire-clay and Lutes	per lb.		0 6		
Glass and Enamel Rods	from		0 3		
Glass Tubing	per lb. from		2 4	0 3 6	
Ditto, Green, free from lead			3 6		
Gauge for showing the expansion of metals by heat				0 5 0	
Hydrogen Lamps	21s.	30 0		2 2 0	
Hope's Eudiometer				0 10 6	
High Pressure Boiler and Stand, with Barometer Tube, Thermometer, and Lamp, complete				3 3 0	
Horizontal Revolving Jet, for exhibiting Philosophical Fire-works with Hydrogen Gas		7 0			
Hydrometers	from	7 0			
Lactometers, for ascertaining the relative value of Milk	per set			0 14 0	
Mortars, Agate	from	5 0 to		2 2 0	
Ditto, Iron		1 9			
Ditto, Composition—No. 0000				0 1 3	
" " 000				0 1 6	
" " 00				0 2 0	
" " 0				0 2 3	
" " 1				0 2 6	
" " 2				0 3 0	
Ditto, Glass	from			0 2 0	
Muffles, Earthenware		0 6			
Mercurial Troughs, Mahogany	"	6 0			
Ditto ditto Iron	"	6 0			
Models of Crystals, in Wood	per set			0 7 6	
Ditto ditto, in Glass	"			0 18 0	
Measure Glasses, from 1 oz. to 20		1 6 to		0 4 0	
One gallon Tin Still, with Worm and Tub complete		21 0		1 5 0	
Ditto Copper ditto ditto				2 2 0	
Ditto ditto ditto, with Iron Furnace				4 4 0	
Pneumatic Troughs of various sizes	4s. 6d.	10 6		0 16 0	
Pepy's Improved Gas Holder, which, with the addition of a Jet, forms a most convenient Hydraulic Blowpipe	30s., 42s.	52 6		3 3 0	
Ditto small Balneo, or Filter Bath, for drying precipitates or explosive compounds, at a heat not exceeding 212° Far.				0 10 0	
Plates of Glass for covering Air Jars		0 6 to		0 2 6	
Precipitating Glasses, 1 pint				0 0 9	
Ditto ditto, 1/2 pint				0 1 0	
Palmer's Oxy-Hydrogen Jet	each			1 1 0	
Ditto, with Bladders, &c.				2 2 0	
Platinum Spoons	from	1 6		1 0 0	
Ditto Forceps	from	3 0			
Pulse Tubes	each			0 1 3	
Retorts, Earthenware					
Ditto ditto Tubulated					
Ditto, Cast Iron, with connecting Tube for the production of Oxygen and other Gases	each			0 10 0	
Retort Stands, Iron, with 3 sliding Rings	from	4 6 to		0 7 6	
Ditto ditto Brass, ditto		8 0		0 14 0	
Reflectors, for experiments on Radiant Heat				2 2 0	
Retorts, best glass:—					
2 ounces, plain	£0 0 5	Stoppered or Tubulated		0 1 0	
4 ditto	0 0 6	ditto		0 1 4	
8 ditto	0 0 9	ditto		0 1 8	
Pint	0 1 0	ditto		0 2 0	
Quart	0 2 0	ditto		0 3 9	
3 pint	0 2 6	ditto		0 4 9	
2 quart	0 3 0	ditto		0 5 3	
1 gallon	0 3 6	ditto		0 6 6	
2 ditto	0 4 6	ditto		0 9 0	
3 ditto	0 5 6	ditto		0 11 0	
4 ditto	0 7 6	ditto		0 15 0	

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	£	s.	d.		s.	d.	£	s.	d.
Receivers, glass :—									
¼-pint, plain . . . . .	0	0	8	Tubulated . . . . .			0	1	2
ditto . . . . .	0	0	9	ditto . . . . .			0	1	3
Pint . . . . .	0	1	0	ditto . . . . .			0	1	6
Quart . . . . .	0	1	9	ditto . . . . .			0	2	6
3 Pint . . . . .	0	2	6	ditto . . . . .			0	3	9
12 Quart . . . . .	0	3	6	ditto . . . . .			0	4	9
Ditto quilled, ¼ pint, 1s. 6d.—½ pint, 1s. 9d.—pint, 2s. 6d.									
Spirit Lamps, Glass . . . . .				2s., 3s., 4 0			0	5	0
Ditto Brass . . . . .							0	7	0
Ditto with Concentric Wick and double Current of Air, on Professor Rose's principle, mounted on a Stand . . . . .							0	18	0
Thorntwain's Analysis Lamp . . . . .							2	2	0
Still, Working Models of . . . . .				30 0			0	2	6
Syphons, Glass . . . . .									
Ditto Pewter and Copper, with Stop Cock . . . . .				from 7 0			0	3	0
Stop Cocks, Brass . . . . .				each					
Small Iron Wire, for combustion in Oxygen Gas . . . . .							0	11	0
Steel Crushing Mortars and Pestles . . . . .				each					
Thermometers . . . . .				from 4 6					
Ditto Chemical . . . . .				from 15 0					
Test Glasses— . . . . .							0	7	0
1½ oz. . . . .				per doz.			0	8	0
3 oz. . . . .							0	9	0
5 oz. . . . .							0	10	0
7 oz. . . . .							0	3	6
Test Tubes . . . . .				per doz.	2 0 to				
Ditto Stands . . . . .				from 1 0			0	0	6
Test-tube Holders . . . . .							0	0	10
Tube Retorts . . . . .				0 6 to					
Tubes, Earthenware . . . . .				from 0 9					
Test Papers of Litmus and Turmeric . . . . .				each 0 1					
Woulf's Apparatus of three bottles, with three necks each, mounted with Conducting and Safety Tubes, in a Mahogany Tray, pints 16 0									
Ditto ditto . . . . .				quarts 20 0					
Water Hammers . . . . .				each 4 0			0	2	0
Welter's Tube of Safety . . . . .							0	0	6
Watch-glass Holders . . . . .									

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perfectly pure, for Analysis and other purposes, in sets, from 21s. to £10 10s., or, singly, in any quantity that may be required for the Arts or Manufactures. See complete list, with prices, in General Catalogue.

	s.	d.		s.	d.
Acid, Acetic . . . . .	0	2	oz.	Acid, Benzoic . . . . .	3 0
" Strongest . . . . .	1	0	"	" Boracic . . . . .	1 0
" Arsenious . . . . .	0	3	"	" Citric . . . . .	1 0
" Arsenic . . . . .	1	0	"	" Fluo Silicic . . . . .	0 6

Philosophical Apparatus, &c., sold by HORNE, THORNTWAIN, & WOOD, 123, Newgate Street, London.



	<i>s. d.</i>
Acid, Gallic . . . . .	5 0 oz.
Hydriodic Sol. . . . .	1 6 "
Muriatic, Common . . . . .	0 3 lb.
" Pure . . . . .	0 2 oz.
Nitrous . . . . .	1 4 lb.
Nitric . . . . .	1 4 "
" Pure . . . . .	0 4 oz.
Nitro Muriatic . . . . .	0 4 "
Oxalic, Common . . . . .	0 3 "
" Pure . . . . .	0 6 "
Phosphoric, Sol. . . . .	1 3 "
" Glacial . . . . .	1 6 "
Pyroligneous . . . . .	1 0 lb.
Succinic . . . . .	5 0 oz.
Sulphuric, Common . . . . .	0 3 lb.
" Pure . . . . .	0 2 oz.
Tartaric, Common . . . . .	0 3 "
" Pure . . . . .	0 6 "
Alloys, various. . . . .	
Æther, Acetic . . . . .	1 0 oz.
Pyroligneous, imp. pt. . . . .	1 6 "
Sulphuric . . . . .	0 6 "
Rectified . . . . .	0 9 "
Nitric . . . . .	0 8 "
Alumine . . . . .	1 6 oz.
Acetate, Sol. . . . .	0 4 "
Amber . . . . .	0 6 "
Ammonia, Solution . . . . .	0 2 "
Strong . . . . .	0 3 "
Carbonate, Pure . . . . .	0 3 "
Hydro Sulph. Sol. . . . .	0 6 "
Muriate . . . . .	0 2 "
" Pure . . . . .	0 6 "
Nitrate . . . . .	5 4 lb.
Oxalate . . . . .	1 0 oz.
Phosphate . . . . .	0 8 "
Sulphate . . . . .	0 3 "
Succinate . . . . .	8 0 "
Antimony . . . . .	0 3 "
Glass . . . . .	0 3 "
Nitro Muriate, Sol. . . . .	0 2 "
Oxides . . . . .	1 0 "
Sulphuret . . . . .	0 8 lb.
Archil . . . . .	0 2 oz.
Arsenic . . . . .	0 6 "
Sulphurets . . . . .	0 4 "
Baryta . . . . .	2 6 "
Crystals . . . . .	0 3 "
Carbonate . . . . .	0 4 "
" Native . . . . .	0 4 lb.
Chlorate . . . . .	2 6 oz.
Muriate . . . . .	0 6 "
Nitrate . . . . .	0 6 "
Sulphate . . . . .	0 4 "
Barytic Water . . . . .	0 6 "
Bismuth . . . . .	0 3 "
Oxide . . . . .	1 0 "
Nitrate . . . . .	1 6 "
Nitrate Solution . . . . .	0 6 "
Borax . . . . .	0 2 "
Bromine . . . . .	
Cadmium . . . . .	2 0 dm.
Oxides . . . . .	2 0 "
Calcium, Chloride, Fused . . . . .	1 0 oz.

	<i>s. d.</i>
Calcium, Sulphuret . . . . .	0 4 oz.
Carbon, Sulphuret . . . . .	1 0 "
Charcoal, Animal . . . . .	0 3 "
Boxwood . . . . .	0 6 "
Copper, Granulated . . . . .	3 0 lb.
Acetate . . . . .	1 0 oz.
Copper Carbonate . . . . .	0 6 "
Foil . . . . .	0 3 "
Leaf . . . . .	0 2 bk.
Muriate . . . . .	0 6 oz.
Nitrate . . . . .	0 3 "
Oxides . . . . .	1 6 "
Sulphate, Common . . . . .	0 6 lb.
" Pure . . . . .	0 3 oz.
Sulphuret . . . . .	0 6 "
Turnings . . . . .	3 0 lb.
Cobalt . . . . .	10 0 oz.
Acetate, Solution . . . . .	1 0 "
Muriate, Solution . . . . .	1 0 "
Oxide, Common . . . . .	5 0 "
" Pure . . . . .	10 0 "
Fluor, Spar . . . . .	0 8 lb.
Flux, Black . . . . .	0 6 oz.
White . . . . .	0 6 "
Galls . . . . .	0 2 "
Tincture . . . . .	0 3 "
Gold Chloride, Solution . . . . .	5 0 "
Leaf . . . . .	1 9 bk.
Iodine . . . . .	
Iron, Acetate . . . . .	0 4 oz.
Carbonate . . . . .	1 0 lb.
Chromate . . . . .	0 6 "
Filings . . . . .	0 6 "
Muriate . . . . .	0 6 oz.
Nitrate, Solution . . . . .	0 3 "
Oxides . . . . .	0 6 "
Sulphate . . . . .	0 2 "
Sulphuret . . . . .	0 8 lb.
Turnings . . . . .	0 6 "
Lead . . . . .	0 2 oz.
Acetate . . . . .	0 2 "
Bin Acetate, Pure . . . . .	0 6 "
Carbonate . . . . .	0 2 "
Chromate . . . . .	0 6 "
Granulated . . . . .	1 6 lb.
Nitrate . . . . .	0 6 oz.
Oxides . . . . .	
Tartrate . . . . .	0 6 "
Lime, Carbonate . . . . .	0 1 "
Chloride . . . . .	0 8 lb.
Fluate . . . . .	0 8 "
Lime, Muriate, Crystals . . . . .	0 6 oz.
" Fused . . . . .	1 0 "
Phosphate . . . . .	0 3 "
Lime, Phosphuret . . . . .	1 0 "
Litmus . . . . .	0 6 "
Tincture . . . . .	0 3 "
Lycopodium . . . . .	0 6 "
Magnesia . . . . .	0 8 "
Carbonate . . . . .	0 4 "
Sulphate . . . . .	0 1 "
Manganese, Oxides, Black . . . . .	0 3 lb.
" Grain . . . . .	0 3 "
Mercury, Chloride . . . . .	0 6 oz.

	s.	d.		s.	d.
Mercury, Bi-Chloride . . . . .	0	6 oz.	Silex . . . . .	1	0 oz.
" Nitrate . . . . .	0	6 "	Sodium . . . . .	0	1 gr.
" Oxides . . . . .	1	0 "	Soda, Carbonate . . . . .	0	3 oz.
Naphtha, Rectified . . . . .	2	0 "	" Bi-Carbonate . . . . .	0	3 "
Nickel, Common . . . . .	0	3 "	Strontia . . . . .	2	0 "
" Sulphate . . . . .	1	0 "	" Crystals . . . . .	2	0 "
Phosphorus . . . . .	0	9 "	" Muriate . . . . .	0	6 "
Platinum, Balls . . . . .	1	0 ca.	" Nitrate . . . . .	0	2 "
" Chloride, Sol. . . . .	2	0 oz.	Silver, Leaf . . . . .	1	6 bk.
" Native . . . . .			" Nitrate . . . . .	5	0 oz.
" Sponge . . . . .			" Fused . . . . .	5	0 "
Platinum . . . . .	0	1 gr.	Sulphur, Roll . . . . .	0	4 lb.
Potassium . . . . .	0	6 oz.	" Sublimed . . . . .	0	6 "
Potash, Fused . . . . .	0	6 oz.	Tin . . . . .	0	3 oz.
" Pure . . . . .	2	0 "	" Foil . . . . .	0	3 "
" Carbonate . . . . .	0	9 lb.	" Granulated . . . . .	0	3 "
Potash, Carbonate Pure . . . . .	0	6 oz.	Test Papers, Brazil Wood . . . . .	0	1 sht.
" Bi-Carbonate . . . . .	0	4 "	" Litmus . . . . .	0	1 "
" Chlorate . . . . .	0	6 "	" " Red . . . . .	0	1 "
" Chromate . . . . .	0	6 "	" " Red Cabbage . . . . .	0	1 "
" Bi-Chromate . . . . .	0	6 "	" " Turmeric . . . . .	0	4 lb.
" Hydriodate . . . . .	0	3 "	Zinc . . . . .	0	3 oz.
" Nitrate, Pure . . . . .	0	3 "	" Foil . . . . .	0	8 lb.
" Prussiate . . . . .	0	6 "	" Granulated . . . . .	0	8 "
" " Pure . . . . .	0	4 gr.	" Malleable Sheet . . . . .	0	3 oz.
Selenium . . . . .	0	4 gr.	" Sulphate . . . . .	0	3 oz.

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## AGRICULTURAL CHEMISTRY,

	£	s.	d.
An assortment of all the necessary Apparatus and Chemicals for the complete analysis of Soils and Manures, of the best size and quality, carefully packed in strong iron-bound chest. For a detailed list of the Articles and Chemicals, see General Catalogue. . . . .	42	0	0
Assortment No. 2, containing the same articles as No. 1, but with cheaper balance, platinum crucible, &c. . . . .	30	0	0
Assortment No. 3 . . . . .	21	0	0

The Assortments No. 1, 2, and 3, are calculated for a complete quantitative analysis of any soil or manure, as described in Sir H. Davy's Agricultural Chemistry, Liebig's Works, Professor Johnson's Catechism of Agricultural Chemistry, and other standard works on Agricultural Analysis, and are particularly adapted for Farmer's Clubs, Agricultural Associations, and also for exportation.

Assortment No. 4, containing one or two of each of the most important articles in No. 1 . . . . .	10	10	0
Assortment No. 5, ditto on a small scale . . . . .	5	5	0
Assortment No. 6, ditto ditto . . . . .	3	3	0

The Assortments Nos. 3, 4, 5, and 6, are in the form of chests, the Chemicals arranged at the top, and the Apparatus in a drawer below.

The Farmer's Chest, for roughly ascertaining the comparative quantities of the following ingredients in various samples of soils, with directions—stones, coarse sand, fine sand, clay, lime, moisture, organic matter, and iron . . . . .	2	2	0
Sir H. Davy's apparatus for the analysis of calcareous soils . . . . .	1	10	0
Hydrometric Glass Beads for ascertaining the strength of sulphuric acid for agricultural purposes, per set of three . . . . .	0	6	0

## ELECTRICITY.

			£ s. d.					£ s. d.		
Philosophical Apparatus, &c., sold by HORNE, THORNTHWAITE, & WOOD, 123, Newgate Street, London.	Small Cylinder Electrical Machines . . . . .		1	5	0	Air Pistol . . . . .		0	6	0
	2nd Size . . . . .		2	2	0	Powder Cannon . . . . .		0	5	6
	3rd do. . . . .		3	10	0	Sportsman . . . . .		1	5	0
	4th do. . . . .		4	10	0	Thunder House . . . . .		0	9	0
	5th do. . . . .		6	0	0	Powder ditto . . . . .		1	1	0
	6th do. . . . .		8	0	0	Obelisk . . . . .		0	7	0
	9-in. Plate Machines . . . . .		3	3	0	Egg Stand . . . . .		0	9	0
	12 ditto . . . . .		4	10	0	Image Plates . . . . .		0	9	0
	18 ditto . . . . .		7	10	0	Pith Ball Stand . . . . .		0	5	0
	24 ditto . . . . .		12	0	0	Gold Leaf Electrometer . . . . .		0	16	0
	Set of 5 Spirals . . . . .		2	2	0	Lane's ditto . . . . .		0	7	0
	Spiral on Foot . . . . .		0	8	6	Cavallo's ditto . . . . .		0	15	0
	Hand Spiral . . . . .		0	5	6	Quadrant ditto . . . . .		0	7	0
	Diamond Spotted Jars, 8s. 6d. to . . . . .		0	15	0	Leyden Jars . . . . .	from 3s. 6d. to 1	10	0	0
	Star, in Frame . . . . .		0	8	6	Pith Balls, per doz. . . . .	1s. to 0	2	0	0
	Bird, in Frame . . . . .		0	8	6	Pith Figures, each . . . . .	from 0	1	0	6
	Luminous Conductors . . . . .	from 0	10	6	Head of Hair . . . . .		0	7	0	
	Magic Picture . . . . .		0	7	6	Electrophorus . . . . .	from 0	10	6	
	Flask . . . . .		0	6	6	Batteries . . . . .	from 10s. to 10	0	0	0
	Spider Jar . . . . .		0	8	6	Insulated Stools . . . . .	from 0	10	6	
	Cuthbertson's Discharger . . . . .		2	2	0	Amalgam . . . . .	per box 0	1	0	6
	Universal ditto . . . . .		1	10	0	Bucket and Syphon . . . . .		0	5	6
	Jointed ditto . . . . .		0	10	6	Electrical Cylinders . . . . .	from 0	3	6	
	Gamut of Bells . . . . .		1	16	0	Glass Handles . . . . .		0	1	3
	Set of Five ditto . . . . .		0	18	0	Ditto Legs . . . . .		0	1	6
	Set of Three ditto . . . . .		0	7	6	Pocket Electrical Bottle, and Ribband for charging the same . . . . .		0	7	6
	Air Cannon . . . . .	12s.,	0	18	0					

## PNEUMATICS.

Philosophical Apparatus, &c., sold by HORNE, THORNTHWAITE, & WOOD, 123, Newgate Street, London.	Single Barrel Air Pump, with Receiver . . . . .	21s., 25s.,	1	10	0
	Ditto ditto, with Fountain . . . . .		2	5	0
	Small Size Double Barrelled Pump . . . . .	3l. 10s.,	4	14	6
	Middle Size ditto ditto . . . . .		7	7	0
	Ditto, with Guage Plate . . . . .		8	8	0
	Ditto, with raised Plate . . . . .		9	9	0
	Large Size Double Barrelled Air Pump . . . . .		12	12	0
	Ditto on Stage Stool . . . . .		19	0	0
	Single Transferer . . . . .		0	16	0
	Double ditto . . . . .		2	2	0
	Guinea and Feather Apparatus, 3 falls . . . . .		1	4	0
	Ditto ditto, 2 falls . . . . .		0	16	0
	Syringe and Lead Weight . . . . .		0	12	0
	Fountain in Vacuum, best make . . . . .		0	15	0
	Ditto ditto common . . . . .		0	7	6
	Lungs Glass . . . . .		0	7	6
	Bladder Frame and Lead Weights . . . . .		0	7	6
	Filtering Cup . . . . .		0	6	6
	Fruit Stand . . . . .		0	5	0
	Wheel and Upright Barometers . . . . .	from 3	3	0	0
	Open and Close Receivers for Air Pump . . . . .	from 0	3	6	6
	Bladder Glass for ditto . . . . .		0	3	6
	Model of a Water Pump, showing the principle and absurdity of the term "Suction" . . . . .	21s.,	1	10	0
	Ditto of Forcing ditto . . . . .		2	15	6
	Large Size Hemisphere . . . . .		1	10	0
	Middle ditto . . . . .		0	18	0
	Small ditto . . . . .		0	15	0
	Bacchus . . . . .		1	8	0

	£	s.	d.
Wind Mills on a new and superior construction . . . . .	3	3	0
Copper Bottle, Beam, and Stand . . . . .	2	15	0
Bell Experiment . . . . .	from 10s.	to 1	1 0
Exhausting and Condensing Syringes . . . . .	0	7	0
Ditto, in one Instrument . . . . .	0	10	0
Pocket Condensers for Instantaneous Light . . . . .	0	3	0
Sliding Wire, and Collar . . . . .	0	12	6
Ditto ditto Thornthwaite's Improved, with ball and socket joint . . . . .	0	17	6
Model of Diving Bell . . . . .	1	5	0

### GALVANISM, OR VOLTAIC ELECTRICITY.

Cruikshank's Batteries, in Mahogany Troughs . . . . .	from 1 <i>l.</i> 1s. 0d.	to 5	5	0
Grove's Platinum Batteries, excited with dilute muriatic acid in connection with the zinc, and strong nitric acid in connection with the platinum, from Smee's Batteries, in round earthenware pots, so constructed that the zines can be readily replaced by means of a binding screw, without the trouble of soldering or bending:—		1	15	0
Pints . . . . .		0	10	0
Quarts . . . . .		0	12	6
4-Quart . . . . .		1	5	0
6-Pint ditto, in mahogany tray, so constructed that they may be arranged for quantity or intensity, with flexible conducting wires . . . . .		3	3	0
6-Quart ditto, ditto . . . . .		3	17	6
Ditto ditto, in Wollaston's troughs of 12 cells, with double zines, and the silver plates, presenting a surface of 252 square inches . . . . .		5	5	0
Ditto ditto, of 432 inches . . . . .		6	6	0
Cast-Iron, or Maynooth Batteries, per cell . . . . .		0	7	6
Every description of Apparatus connected with MAGNETISM and ELECTRO-MAGNETISM, for which see General Catalogue.				

### ELECTRO-METALLURGY.

ELECTROTYPE APPARATUS for procuring, by galvanic action, perfect fac-similes of engraved copper-plates, however elaborate; also, correct copies of medals, seals, plaster casts, and all kinds of metallic ornaments, from 10s. 6d. to 3*l.* 3s. 0d. and upwards.

### OPTICAL APPARATUS.

The Patent Pantoscopic Spectacles, the most recent and scientific invention for the improvement of sight, from 7s. 6d. to 25s.; if gold mounted, to £3 3s. See "Smee on Vision in Health and Disease, and the Value of Glasses for its Restoration," p. 61. Price 1s.

### MICROSCOPES.

Single Microscopes for Botanical and other purposes . . . . .	from 5s.	to 1	10	0
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### ACHROMATIC MICROSCOPES.

Horne and Co.'s improved Medical Compound Achromatic Microscope, with achromatic object-glass, box, brass forceps, &c. &c., magnifying power, from 1000 to 8000, packed in mahogany case or cabinet . . . . .	5	5	0
Ditto, with jointed pillar and fine adjustment, test objects, &c., magnifying power varying from 1000 to 12,000 . . . . .	7	10	0
Ditto, ditto, magnifying power from 1000 to 25,000 . . . . .	10	10	0
Ditto, ditto, ditto 1000 to 50,000, with extra eye piece, &c. . . . .	15	15	0
Very superior Compound Achromatic Microscope, with moveable and safety stage, fine adjustment, two eye-pieces, and two sets of achromatic object-glasses, capable of magnifying from 1500 to 100,000 times, plane and concave mirrors, detached condensing lens, aquatic box, brass forceps, &c., and six objects mounted in balsam, the whole packed in neat mahogany cabinet . . . . .	21	0	0
Ditto, ditto, of higher magnifying power, and fitted with achromatic condenser, silver specula, polarizing apparatus, &c. . . . .	from £35	to £0	0 0

Messrs. Horne, Thornthwaite, and Wood, beg to call particular attention to their Achromatic Microscopes, which are constructed on the best principles, and can confidently be recommended for all purposes of microscopic research, which now forms such an important feature in the study of animal and vegetable physiology, &c.

Philosophical Apparatus, &c., sold by HORNE, THORNTHWAITE, & WOOD, 123, Newgate Street, London.

Magie and Phantasmagoria Lanterns, Slides, &c., from 16s. to £5 5s., and upwards; if for exhibiting Astronomical Diagrams, Views, &c., from £1 10s. to £21 and upwards. Oxy-Hydrogen Microscopes, Chromatopes, &c.

### DISSOLVING VIEWS

(As shown at the Royal Polytechnic Institution.)

	£	s.	d.
Complete Apparatus, with Lenses 3 inches diameter, illuminated with Argand Oil Lamps, capable of showing a disk 9 feet in diameter . . . . .	10	10	0
Views for ditto . . . . . from 7s. 0d. to . . . . .	0	10	0
Dissolving View Apparatus, illuminated with the Oxy-Hydrogen or Line Light, capable of showing pictures 20 feet diameter, consisting of a pair of mahogany lanterns, with brass fronts, and dissolving apparatus, 2 pair of 4 inch lenses or condensers, 2 oxy-hydrogen jets and line burners, flexible tube connections, 2 large India rubber bags and pressure boards, lead bottle, tube, and purifier, for making hydrogen gas, iron retort, &c., for oxygen gas, folding mahogany tripod stand, &c., complete . . . . .	42	0	0
Ditto,                      Ditto,                      with 6 inch condensers . . . . .	61	0	0
Ditto,                      Ditto,                      9 inch ditto . . . . .	85	0	0
Views for                      Ditto, from 25s. to 80s. each, and upwards.			
Oxy-Hydrogen Microscope, with objects fitted to the above . . . . .	15	15	0
Ditto,                      Ditto,                      complete with the gas apparatus, &c. . . . .	35	0	0

### ACHROMATIC TELESCOPES.

18-inches long, with rack and pinion, on stand . . . . .	8	8	0
Ditto, ditto, in German silver . . . . .	14	14	0
30-inch ditto . . . . .	12	12	0
Ditto, with vertical rack . . . . .	14	14	0
Ditto, with vertical and horizontal rack . . . . .	21	0	0
Ditto, with finder and micrometer . . . . .	23	10	0
42-inch, with rack and pinion . . . . .	30	0	0
42-inch, with vertical rack . . . . .	32	0	0
42-inch, with vertical and horizontal rack-work movement, finder, and micrometer . . . . .	33	0	0
Ditto, with extra large object glass . . . . .	40	0	0
Ditto, with equatorial stands . . . . . extra	30	0	0
Telescopes, from 5 to 7 feet, with all the recent improvements, from £100 to 300 . . . . .			
The whole of the above Astronomical Telescopes are furnished with two-day powers, and two or more astronomical powers, and are packed in cases.			

### REFLECTING TELESCOPES, &c.

One-foot Gregorian Reflecting Telescope, on stand, packed in mahogany case, speculum 9½ inches diameter . . . . .	6	6	0
One-foot and a-half ditto, speculum 3 inches diameter . . . . .	11	11	0
Two-feet ditto, speculum 4 inches diameter . . . . .	16	16	0
Ditto ditto, with rack-work motion . . . . .	25	0	0
Three-feet ditto, with speculum 5 inches diameter, and rack-work motion . . . . .	42	0	0
Ditto ditto, with speculum 6 inches diameter, on tripod stand, and rack-work motion . . . . .	63	0	0
Four-feet ditto ditto, with speculum 7 inches diameter . . . . .	105	0	0
Seven-feet Newtonian Telescope, with speculum 6 inches diameter . . . . .	105	0	0
Ditto ditto, with speculum 7 inches diameter . . . . .	126	0	0
Nine-feet ditto, with speculum 9 inches diameter . . . . .	210	0	0
Transit Instruments . . . . . from £20 to 180 . . . . .			
Micrometers, &c., &c.			

### QUADRANTS, SEXTANTS, &c.

Ebony Quadrants . . . . .	12	5	0	to	3	3	0
Ditto ditto with Tangent crew . . . . .					3	10	0
Ditto ditto with Telescopes . . . . . from	4	4	0		6	6	0

	£	s.	d.	£	s.	d.
Ebony Sextants, best . . . . .				7	7	0
Metal Sextants, on the most improved principle . . . . .	7	7	0	12	12	0
Ditto, of the best possible construction, divided to 15 sec. or 30 sec., with apparatus, &c., in case . . . . .	12	12	0	18	18	0
Artificial Horizons . . . . .	2	2	0	5	5	0
Cabin and Binnacle Compasses . . . . .	1	10	0	5	5	0
Azimuth Compasses . . . . .	4	4	0	10	10	0
Universal and Ring Dials . . . . .	1	5	0	5	5	0
Pocket Compasses, of every description.						

### THEODOLITES.

Common Theodolite . . . . .	9	9	0
4-inch do. do. with Telescope . . . . .	12	12	0
Ditto, divided on silver . . . . .	13	13	0
5-inch ditto . . . . .	18	0	0
Ditto, best construction, with Tangent Screw motion . . . . .	21	0	0
Ditto, with two Telescopes . . . . .	36	0	0
6-inch best Theodolite, divided to 20 seconds, with one Telescope . . . . .	28	0	0
7-inch ditto ditto, with two Telescopes . . . . .	42	0	0

### LEVELS, COMPASSES, &c.

Portable Levelling Instrument, with Telescope and Compass . . . . .	8	8	0
14-inch Troughton's Level . . . . .	11	0	0
Ditto, with Tripod Staff . . . . .	12	0	0
20-inch Troughton's Level . . . . .	13	0	0
Ditto, with Tripod Staff . . . . .	14	0	0
20-inch Y Levels, with Telescope . . . . .	16	0	0
Dumpy Level, without legs or compass . . . . .	12	0	0
14-inch Dumpy Level, with legs and compass . . . . .	15	0	0
Common Spirit Levels . . . . .	3s., 4s., 5s., 6s., and	0	10
Spirit Levels, with best Ground Bubbles.			
Miners' Magnetic Compasses, in mahogany cases, with folding sights, from . . . . .	1	15	0
Prismatic Compasses . . . . .	from £2 12 6 to	3	13 6
Protractors . . . . .	0 2 6 to	7	7 0
Perambulator . . . . .		9	9 0
Ditto, brass mounted . . . . .		12	0 0
Ditto ditto and metal wheel . . . . .		14	0 0
Station Staffs . . . . .	from	2	15 0
Surveying Crosses or Squares . . . . .	from 12s. to	1	11 6
Cylindrical ditto . . . . .	from 18s. to	1	12 0
Circumferentors . . . . .	from £2 12s. 6d. to	6	6 0
Plane Tables . . . . .	from £5 10s. to	12	12 0
Measuring Chains . . . . .	from	0	10 0
Plotting, Marquois, Gunter's Scales, and other Rules.			

### DRAWING INSTRUMENTS.

In Fish Skin Cases, in sets . . . . .	from £0 7s. 6d. to	2	2 0
Magazine Sets, in mahogany cases . . . . .	£2 10s. 0d. to	18	18 0
Proportional Compasses . . . . .	£1 13s. 0d. to	5	5 0

N. B.—Every other description of Instrument used in Practical Surveying.

### BAROMETERS, &c.

Best Wheel Barometers . . . . .	from £3 3 0 to	10	10 0
Upright ditto . . . . .	1 10 0	7	7 0
Marine ditto . . . . .	3 3 0	6	6 0
Standard Barometers of the best construction . . . . .		12	12 0
Improved Siphonometer . . . . .		3	3 0
Day and Night Self-Registering Thermometers . . . . .	1 1 0	1	10 0
Six's ditto, ditto . . . . .	from 1 5 0	2	2 0
Thermometers of all descriptions . . . . .	0 2 6	5	0 0
Hygrometer (Daniell's) . . . . .		2	5 0
Ditto (Mason's) . . . . .		2	10 0
Pluviometers . . . . .	from	1	10 0

## EDUCATIONAL MODELS.

		s. d.	
A	Set of the Mechanical Powers, consisting of various systems of pulleys, different kinds of levers, the wheel and axle, the inclined plane, wedge, model of the screw, a compound engine, and other apparatus complete for illustrating and demonstrating the laws of motion, gravity, and equilibrium of forces, &c., on an extensive scale, <i>in brass</i> . . . . .	50	0 0
	Ditto, ditto, on a smaller scale, suitable for schools, &c. . . . .	21	0 0
	Ditto, ditto, chiefly constructed of mahogany and hardwood, £3 3s., £5 5s., and	8	8 0
	Sets of Geometrical Solids from 9s., if with planes and sections for cone and sphere, from 15s. Sectional and other Models of Steam Engines, Hydraulic Presses, and various other Machines, &c., &c.		

## GLOBES,

Constructed on the newest and best principles, from 6 to 20 inches diameter, containing all the recent discoveries.

Black stained wood frames for the table, particularly applicable for schools—			
20 inch, per pair . . . . .		9	10 0
15 ditto . . . . .		6	0 0
12 ditto . . . . .		4	0 0
9 ditto . . . . .		3	0 0
3 ditto . . . . .		1	15 0
Mahogany frames—			
20 inch, per pair . . . . .		10	10 0
15 ditto . . . . .		6	10 0
12 ditto . . . . .		4	10 0
9 ditto . . . . .		3	10 0
6 ditto . . . . .		2	2 0
Carved rosewood frames, very handsome—			
20 inch, per pair . . . . .		13	0 0
15 ditto . . . . .		8	8 0
12 ditto . . . . .		6	6 0
9 ditto . . . . .		4	14 6

If the above Globes are required on chair-high frames, with compass boxes, the price will be from £2 2s. to £4 4s. extra, according to the size.

Orteries, Planatariums, Tellurians, &c., &c., to order . . . . . from 2 10 0

## PHOTOGRAPHIC APPARATUS.

No. 1.	Horne and Co.'s complete Apparatus for Daguerreotype and Calotype Processes, for obtaining pictures from 8½ by 6½ downwards, with every requisite for views, portraits, miniatures, &c., including best adjusting camera, with compound achromatic lens, double backs for plates and paper, camera stand, improved bromine and iodine apparatus, plate boxes, polishing frame, mercury box, buffs, washing apparatus, spirit lamp, gilding stand, all the requisite chemicals in stoppered bottles, &c., the whole packed in two cases, with locks and keys . . . . .	£70 to 100	0 0
No. 2.	Daguerreotype Apparatus complete, for pictures, 8½ by 6½, 6 by 5, 5 by 4, with double achromatic lens, expanding camera, iodizing and bromine apparatus, mercury box, plate boxes, polishing blocks, buffs, gilding stand, spirit lamp, and all the requisite chemicals, &c. . . . .	40	0 0
No. 3.	Ditto, ditto, for pictures 5 by 4, 4 by 3, and 2½ by 3½ . . . . .	30	0 0
No. 4.	Ditto, ditto, ditto, 4 by 3, 2½ by 3½, and 2½ by 2 . . . . .	£18 18s. and	20 0 0
No. 5.	Ditto, ditto, ditto, 3½ by 2½, and 2½ by 2 . . . . .	£10 10s. and	12 12 0
No. 6.	Daguerreotype Apparatus complete, with single achromatic lenses, from £6 6s. to . . . . .	22	0 0
Calotype Apparatus complete, for obtaining pictures on paper, including a Cundell's camera of best construction, the requisite chemicals in stoppered bottles, scales and weights, reversing frame and glass, glass measure, earthenware trays, glass plates, paper, &c., packed in case, with lock and key . . . . .		£10 10s. and	15 15 0
Ditto, ditto, with fewer apparatus, &c. . . . .		£3 3s., £5 5s., and	8 8 0
Calotype, or Talbotype Apparatus, of the best description, including a folding achromatic camera, and every other requisite for obtaining full-sized pictures, packed in two portable cases, and particularly adapted for travellers . . . . .		25	0 0



Cameras with single achromatic or double achromatic lenses, from £1 1s. 0d. to £20 0s. 0d., according to the diameter of and kind of lens employed.

Horne and Co.'s improved Compound Achromatic Lenses, mounted in brass fronts, with a delicate rackwork adjustment, and brass ring for adaptation to the camera.

No. 1.	For Pictures	8½ by 6½,	combined focus	12 in.,	diameter of lenses	4 in.	25	0	0
No. 2.	Ditto	6 by 5,	Ditto	8 in.,	Ditto	3½ in.	15	15	0
No. 3.	Ditto	8½ by 6½,	Ditto	12 in.,	Ditto	3½ in.	12	12	0
No. 4.	Ditto	4 by 3,	Ditto	6 in.,	Ditto	2½ in.	8	8	0
No. 5.	Ditto	6 by 5,	Ditto	8 in.,	Ditto	2½ in.	7	7	0
No. 6.	Ditto	4 by 3,	Ditto	6 in.,	Ditto	2 in.	4	14	6
No. 7.	Ditto	3½ by 2½,	Ditto	6 in.,	Ditto	1½ in.	3	13	6

Messrs. H., T., and W. have much pleasure in recommending the above combinations, as producing remarkably sharp and brilliant pictures, free from aberration, and in the shortest space of time.

Single Achromatic Lenses, unmounted,—

1½	inch diameter,	4 inch focus, and upwards	.	.	.	.	.	0	6	0
1½	Ditto	5	Ditto	.	.	.	.	0	8	0
1½	Ditto	6	Ditto	.	.	.	.	0	10	6
2	Ditto	8	Ditto	.	.	.	14s. and	1	10	0
3	Ditto	12	Ditto	.	.	.	.	3	3	0

Parallel Mirrors, mounted in frame, to attach to the front of the camera, for taking pictures in a correct position for ¼-plate lenses . . . . . 3 3 0

Ditto ½-plate ditto . . . . . 4 4 0

Plano-Convex, Crossed, Meniscus, and every other description of Lens required in Photographic Experiments.

Silvered Plates, of the best English manufacture, of all sizes.

Plate Boxes, for holding the prepared Plates, in walnut-wood, mahogany, or japanned metal.

Pans of hard glazed Porcelain, for containing iodine or accelerating mixtures, with ground plate glass covers, for any size plates, up to 4 in. by 3 in. . ea. 0 2 0

Ditto, ditto, in mahogany or walnut cases, with three frames for holding the various sized plates . . . . . 0 12 0

Ditto, ditto, with levelling screws, &c. . . . . 1 1 0

Iodine Boxes, lined with glass . . . . . from 0 6 0

Iodizing or Bromine Troughs, with set of frames, consisting of deep glass pan, enclosed in mahogany case, air-tight glass cover, mirror, &c., for plates, 4 by 3 downwards . . . . . £1 4s. and 1 10 0

Ditto, for Plates, 6 by 5 downwards . . . . . each £1 10s. and 2 2 0

Ditto, ditto, 8½ by 6½ ditto . . . . . „ £3 10s. and 4 4 0

### IMPROVED IODIZING AND BROMINE APPARATUS,

Consisting of two stout glass pans, enclosed in mahogany or walnut-wood case, with spring bottoms and air-tight glass covers. Two mirrors are placed on one side, for viewing the plate while being prepared, and, on the other two, apertures for the admission of light. The great advantage of this form of apparatus for preparing plates, consists in the facility and certainty with which the sensitive coatings are applied:—

No. 1, for Plates from 8½ by 6½ downwards . . . . . 8 8 0

No. 2, for Plates from 6 by 5 downwards . . . . . £3 10s. and 4 4 0

No. 3, for Plates from 4 by 3 downwards . . . . . 2 10 0

Plate Cleaners . . . . . from 2s. to 0 6 0

Velvet Buffs, for polishing plain . . . . . from 1s. 9d. to 0 2 6

Ditto, improved, with handle . . . . . 3s. to 0 10 0

Metal Frames for holding the plates, while polishing in lathe or hand:—

For plates, 2½ by 2 . . . . . 0 5 0

Ditto 3½ by 2½ . . . . . 0 7 6

Ditto 4 by 3 . . . . . 0 9 0

Mercury Boxes of the most improved kinds . . . . . from 13s. to 2 2 0

Ditto, of larger size . . . . . from £2 2s. to 4 4 0

Double folding Tripod Stand, with ball and socket movement, &c., £2 2s. and 3 3 0

Ditto, ditto, plain, not jointed . . . . . 1 17 0

Horne and Co.'s improved Portable Universal Stand . . . . . 2 2 0

Ditto, ditto, with jointed top and legs . . . . . 2 15 0

Earthenware Washing Tray and Stand . . . . . 0 3 6



Philosophical Apparatus, &c., sold by HORNE, THORNTWAITE, & WOOD, 123, Newgate Street, London.

Ditto, ditto, small size	£	s.	d.
Washing Trays, in copper and glass		from	0 1 6
Glass Spirit Lamps	2s., 3s., 4s., and		0 2 6
Ditto Graduated Measures	2s., 2s. 6d., and		0 5 0
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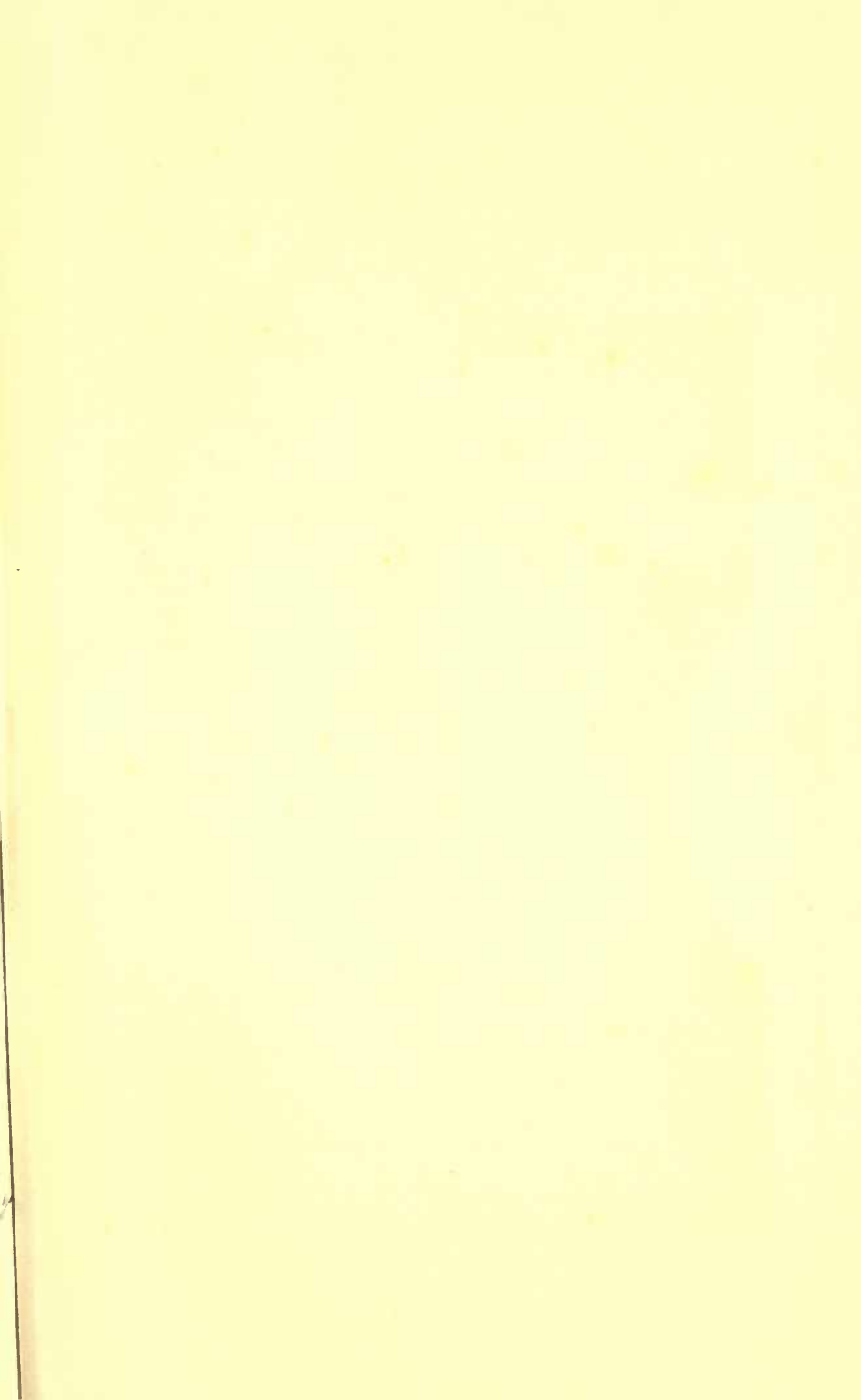
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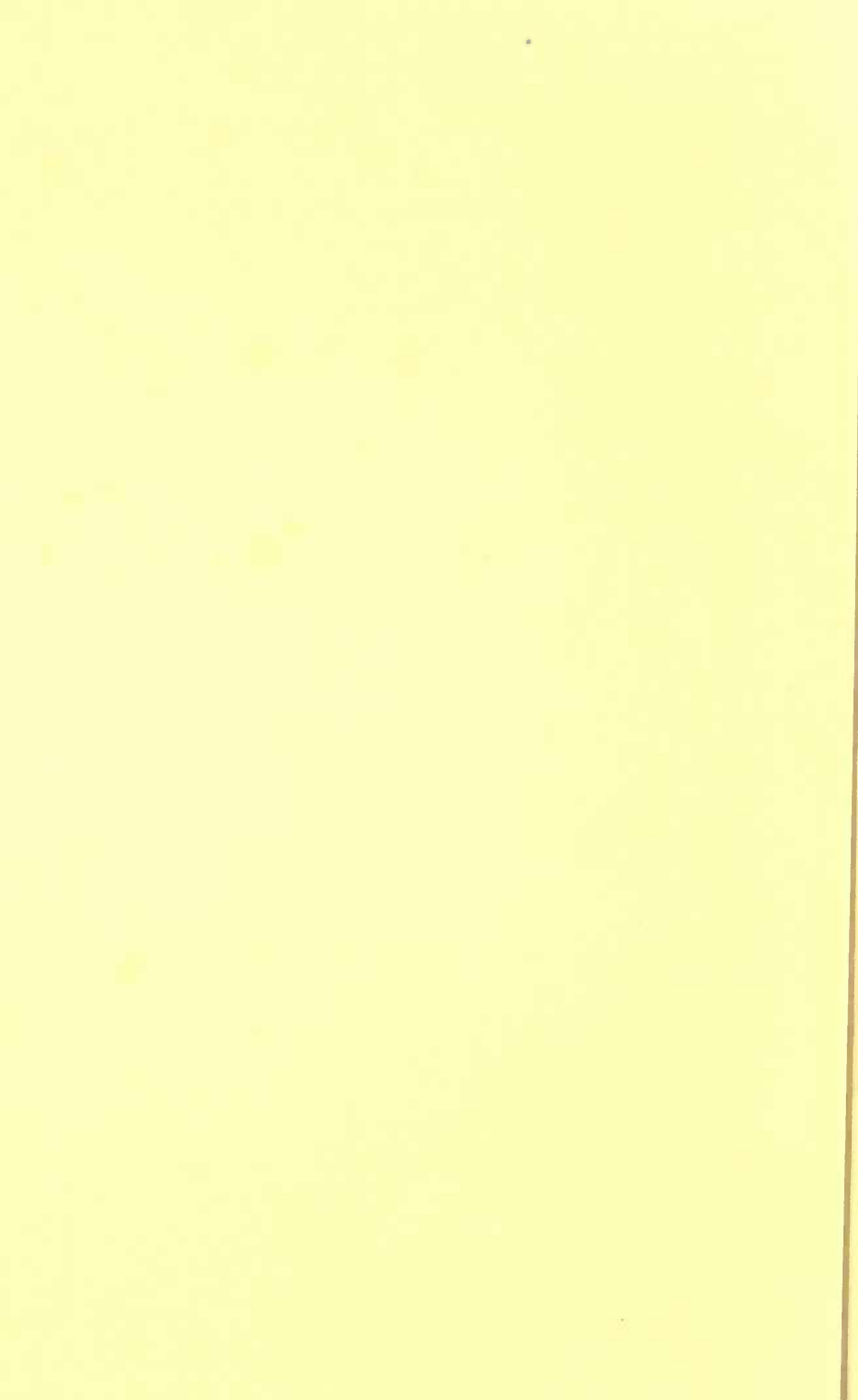
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