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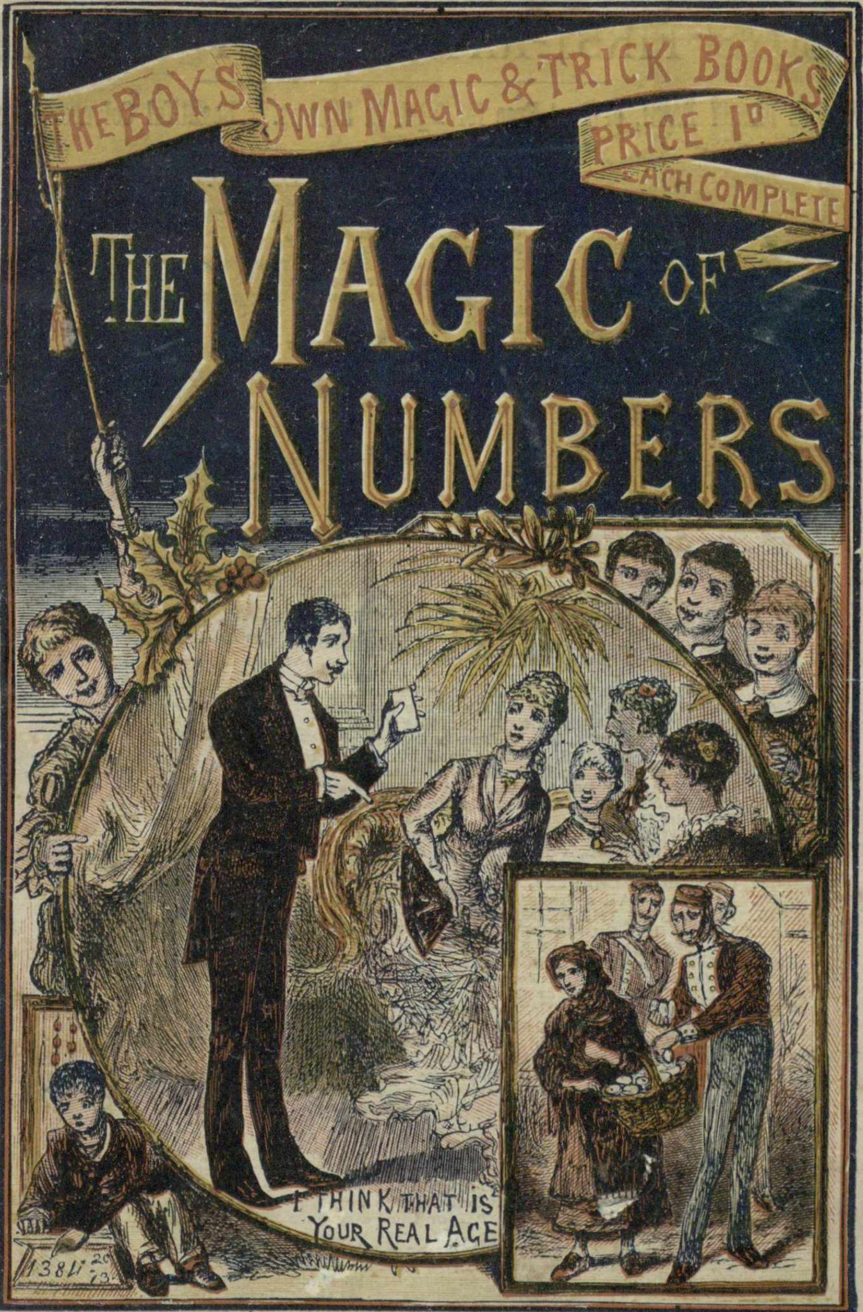

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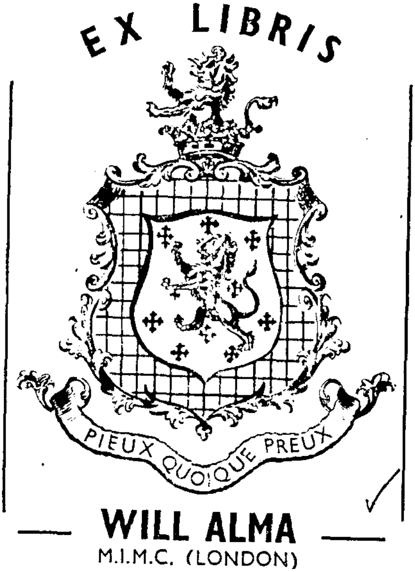


Cocker and Dilworth, Walkingame and Vyse,
In their own sphere, by Bidder were outshone.
They, with pen or pencil, problems solved—
He, with no aid, but wondrous memory;
They, when of years maturé acquired their fame,
He "lisped in numbers for the numbers came."

THE delightful and valuable science of numbers first arrived at any degree of perfection in Europe among the Greeks, who made use of the letters of the alphabet to express their numbers.

A similar mode was followed by the Romans, who, besides characters for each rank of classes, introduced others for five, fifty, and five hundred, which are still used for chapters of books, and some other unimportant purposes.

The common arithmetic, in which the ten Arabic figures, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, are used, was unknown to the Greeks and Romans. They came into Europe by way of Spain from the Arabians, who are believed to have received them from the ancient philosophers of India.

The Arabic system is supposed to have taken its origin from the ten fingers of the hand, which were used in making calculations before arithmetic was brought to an art, and it is to this art that we intend to introduce our readers.

But as the principal object of this volume is to enable them to learn something in their sports, and to understand what they are doing, we shall, before proceeding to the curious tricks and feats connected with the science of numbers, present them with some arithmetical aphorisms, upon which most of the following examples are founded.

Aphorisms of Number.

1. If two even numbers be added together, or substracted from each other, their sum or difference will be an even number.

2. If two uneven numbers be added or subtracted their sum or difference will be an even number.

3. The sum or difference of an even and an uneven number added or subtracted will be an uneven number.

4. The product of two even numbers will be an even number, and the product of two uneven numbers will be an uneven number.

5. The product of an even and an uneven number will be an even number.

6. If two different numbers be divisible by any one number, their sum and their difference will also be divisible by that number.

7. If several different numbers, divided by 3, be added or multiplied together, their sum and their product will also be divisible by 3.

8. If two numbers, divisible by 9, be added together, the sum of the figures in the amount will be either 9, or a number divisible by 9.

9. If any number be multiplied by 9, or by any other number divisible by 9, the amount of the figures of the product will be either 9, or a number divisible by 9.

10. In every arithmetical progression, if the first and last term be each multiplied by the number of terms, and the sum of the two products be divided by 2, the quotient will be the sum of the series.

11. In every geometric progression, if any two terms be multiplied together, their product will be equal to that term, which answers to the sum of these two indices. Thus, in the series—

1	2	3	4	5
2	4	8	16	32

If the third and fourth terms 8 and 16 be multiplied together, the product 128 will be the seventh term of the series. In like manner, if the fifth term be multiplied into itself, the product will be the twentieth term, and if that sum be multiplied into itself, the product will be the twentieth term. Therefore, to find the last, or any other term of a geometric series it is not necessary to continue the series beyond a few of the first terms.

Previous to the numerical recreations, we shall here describe certain mechanical methods of performing arithmetical calculations, such as are not only in themselves entertaining, but will be found more or less useful to the young reader.

Arithmetic.

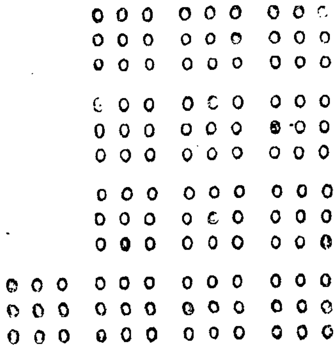
THE blind mathematician, Dr. Saunderson, adopted a very ingenious device for performing arithmetical operations by the sense of touch.

Small cubes of wood were provided, and in one face of each, nine holes were pierced, thus :

1	2	3		o	o	o
4	5	6		o	o	o
7	8	9		o	o	o

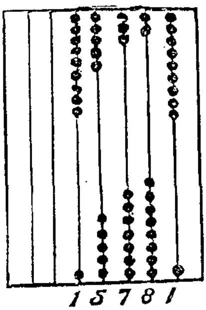
These holes represented the nine digits, as in the figure, and to denote any figure, a small peg was inserted into the hole corresponding to it. If the number consisted of several figures, more cubes were used one for each. A cipher was represented by a peg of different shape from that of the others, and inserted in the central hole.

To perform any arithmetical process, a square board was provided, divided by ridges into recesses of the same width as the cubes, and by this the cubes were retained in the required horizontal and perpendicular lines. Suppose it was necessary to add together the numbers 763, 124, 859, the cubes and pegs would be arranged thus :



The Abacus.

THIS instrument is used for teaching numeration, and the first principles of arithmetic.



Upon a frame are placed, wires parallel to one another and at equal distances. Ten small balls are strung upon each wire, being placed as in the margin. The right wire denotes units, the next tens, and so on, 7th wire being the place of millions. In using the abacus, all the balls are first ranged at one end, and a number of them are then moved to the other end of each wire, to correspond to the figures required. The example given in the margin is 15,781, the height of Mount Blanc.

Progression.

IF a hundred stones be placed in a straight line, at the distance of a yard from each other, the first being at the same distance from a basket, how many yards must the person walk who engages to pick them up, one by one, and put them into the basket? It is evident that to pick up the first stone, and put it into the basket, the person must walk two yards; for the second, he must walk four; for the third, six; and so on, increasing by two, to the hundredth.

The number of yards, therefore, which the person must walk will be equal to the sum of the progression, 2, 4, 6, &c., the last term of which is 200 (22). But the sum of the progression is equal to 202, the sum of the two extremes, multiplied by 50, or half the number of terms; that is to say, 10,100 yards, which makes more than $5\frac{1}{2}$ miles.

The famous forty-five.

HOW can number 45 be divided into four such parts that, if to the first part you add 2, from the second part you subtract 2. the third part you multiply by 2, and the fourth part you divide by 2, the sum of the addition, the remainder of the subtraction, the product of the multiplication, and the quotient of the division must be all equal?

The	1st	is 8;	to which add	2,	the sum is	10
The	2nd	is 12;	subtract	2,	the remainder is	10
The	3rd	is 5;	multiplied by	2,	the product is	10
The	4th	is 20;	divided by	2,	the quotient is	10
		45				

Required to subtract 45 from 45, and leave 45 as a remainder?

SOLUTION.—9+8+7+6+5+4+3+2+1=45
1+2+3+4+5+6+7+8+9=45
8+6+4+1+9+7+5+3+2=45

Subtraction.

FROM 1 mile subtract 7 furlongs, 39 rods, 5 yards, 1 foot, 5 inches.

	miles,	furlongs,	rods,	yards,	feet,	inches.
From	1	0	0	0	0	0
Take	0	7	39	5	1	5
	0	0	0	0	0	1

In this problem, instead of borrowing 1 foot, we borrow $\frac{1}{2}$ a foot=6 inches, from which we take 5 inches, and 1 remains; we then carry $\frac{1}{2}$ to 1, and borrowing $\frac{1}{2}$ a yard=$1\frac{1}{2}$ feet, we have $1\frac{1}{2}$ from $1\frac{1}{2}$=0, and afterwards proceed as usual.

The expunged figure.

IN the first place desire a person to write down secretly, in a line any number of figures he may choose, and add them together as units; having done this, tell him to subtract that sum from the line of figures originally set down; then desire him to strike out any figure he pleases, and add the remaining figures in the line together as units, (as in the first instance,) and inform you of the result, when you will tell him the figure he has struck out.

76542-24
24
————
76518

Suppose for example, the figures put down are 76542; these, added together, as units, make a total of 24; deduct 24 from the first line, and 76518 remain; if 5, the centre figure be struck out, the total will be 22. If 8, the first figure be struck out, 19 will be the total.

In order to ascertain which figure has been struck out, you make a mental sum one multiple of 9 higher than the total given. If 22 be given as the total, then 3 times 9 are 27, and 22 from 27 show that 5 was struck out. If 19 be given, that sum deducted from 27 shows 8.

Should the total be equal multiples of 9, as 18, 27. 36, then 9 has been expunged.

With very little practice any person may perform this with rapidity, it is therefore needless to give any further examples. The only way in which a person can fail in solving this riddle is when either the number 9 or a cipher is struck out, as it then becomes impossible to tell which of the two it is, the sum of the figure in the line being an even number of nines in both cases.

The mysterious addition.

IT is required to name the quotient of five or three lines of figures—each line consisting of five or more figures—only seeing the first line before the other lines are even put down. Any person may write down the first line of figures for you. How do you find the quotient?

EXAMPLE.—When the first line of figures is set down, subtract 2 from the last right-hand figure, and place it before the first figure of the line, and that is the quotient for five lines. For example, suppose the figures given are 86,214, the quotient will be 286,212. You may allow any person to put down the two first and the fourth lines, but you must always set down the third and fifth lines, and in doing so, always make up 9 with the line above, as in the following example,

86,214
42,680
57,319
62,854
37,145
———
Qt. 268,212

Therefore in the annexed diagram you will see that you have made 9 in the third and fifth lines with the lines above them. If the person desire to put down the figures should set down a 1 or 0 for the last figure, you must say we will have another figure, and another, and so on until he sets down something above 1 or 2.

67,856
47,218
52,781
———
Qt 167,855

In solving the puzzle with three lines, you subtract 1 from the last figure, and place it before the first figure, and make up the third line yourself to 9. For example:—67,856 is given, and the quotient will be 167,855, as shown in the above diagram.

To tell at what hour a person intends to rise.

LET the person set the hand of the dial of a watch at any hour he pleases and tell you what hour that is; and to the number of that hour you add in your mind 12; then tell him to count privately the number of that amount upon the dial, beginning with the next hour to that on which he proposes to rise, and counting backwards, first reckoning the number of the hour at which he has placed the hand. For example:—

Suppose the hour at which he intends to rise be 8, and that he has placed the hand at 5; you will add 12 to 5, and tell him to count 17 on the dial, first reckoning 5, the hour at which the index stands, and counting backwards from the hour at which he intends to rise; and the number 17 will necessarily end at eight, which shows that to be the hour he chose.

To find the difference between two numbers the greater of which is unknown.

TAKE as many nines as there are figures in the smallest number, and subtract that sum from the number of nines. Let another person add the difference to the largest number, and taking away the first figure of the amount add it to the last figure, and that sum will be the difference of the two numbers.

For example: John, who is 22, tells Thomas, who is older, that he can discover the difference of their ages; he therefore privately deducts 22 from 99 (his age consisting of two figures, he of course takes two nines); the difference, which is 77, he tells Thomas to add to his age, and to take away the first figure from the amount, and add it to the last figure and that will be the difference of their ages; thus,—

The difference between John's age and 99 is	77
To which Thomas adding his age	35
The sum is	112
Then by taking away the first figure 1, and adding it to the figure 2, the sum is	13
Which add to John's age	22
Gives the age of Thomas	35

The Remainder.

A very pleasing way to arrive at an arithmetical sum, without the use of either slate or pencil, is to ask a person to think of a figure, then double it, then add a certain figure to it, now halve the whole sum, and finally to subtract from that the figure first thought of. You are then to tell the thinker what is the remainder.

The key to this lock of figures is, that HALF, of whatever sum you request to be added during the working of the sum IS THE REMAINDER. In the example given, five is the half of ten, the number requested to be added. Any amount may be added, but the operation is simplified by giving only even numbers, as they will divide without fractions.

Example.

Think of........................7 .
Double it......................14
Add 10 to it...................10

Halve it.....................2)24

Which will leave...............12
Subtract the number thought of....7

The REMAINDER will be..........5

A person having an equal number of counters or pieces of money in each hand, to find how many he has altogether.

Request the person to convey any number, as 4, for example, from the one hand to the other, and then ask how many times the less number is contained in the greater. Let us suppose that he says the one is the triple of the other; and in this case, multiply 4, the number of the counters conveyed, by 3, and add to the product the same number, which will make 16. Lastly, take 1 from 3, and if 16, be divided by the remainder 2, the quotient will be the number contained in each hand, and consequently the whole number is 16.

This curious problem deserves another example. Let us again suppose that 4 counters are passed from one hand to the other, and the less number is contained in the greater $2\frac{1}{3}$ times. In this case we must, as before, multiply 4 by $2\frac{1}{3}$, which will give $9\frac{1}{3}$; to which if 4 be added, we shall have $13\frac{1}{3}$, or $\frac{40}{3}$: if 1, then, be taken from $2\frac{1}{3}$, the remainder will be $1\frac{1}{3}$, or $\frac{4}{3}$, by which, if $\frac{40}{3}$ be divided, the quotient 10 will be the number of counters in each hand.

The three jealous Husbands.

THREE jealous husbands, A, B, C, with their wives, being ready to pass by night over a river, find at the water side a boat which can carry but two at a time, and for want of a waterman they are compelled to row themselves over the river at several times. The question is how those six persons shall pass, two at a time, so that none of the three wives may be found in the company of one or two men unless her husband be present?

This may be effected in two or three ways; the following may be as good as any:—Let A and wife go over—let A return—let B's and C's wives go over—A's wife returns—B and C go over—B and wife return, A and B go over—C's wife return's, and A's and B's wives go over—then C comes back for his wife. Simple as this question may appear, it is found in the works of Alcuin, who flourished a thousand years ago, hundreds of years before the art of printing was invented.

The false scales.

A CHEESE being put into one of the scales of a false balance, was found to weigh 16 lbs., and when put into the other only 9 lbs. What is the true weight?

The true weight is a mean proportional between the two false ones, and is found by extracting the square root of their product. Thus $16\times9=144$; and square root $144=12$ lbs., the weight required.

The apple woman.

A POOR woman, carrying a basket of apples, was met by three boys, the first of whom bought half of what she had, and then gave her back 10; the second boy bought a third of what remained, and gave her back 2; and the third bought half of what she had now left and returned her 1; after which she found she had 12 apples remaining, What number had she at first?

From the twelve remaining, deduct 1, and 11 is the number she sold the last boy, which was half she had; her number at that time, therefore, was 22. From 22 deduct 2, and the remaining 20 was $\frac{2}{3}$ of her prior stock, which was therefore 30. From 30 deduct 10, and the remainder 20 is half her original stock; consequently she had at first 40 apples.

The Graces and Muses.

THE three Graces, carrying each an equal number of oranges, were met by the nine Muses, who asked for some of them: and each Grace having given to each Muse the same number, it was then found that they had all equal shares, How many had the Graces at first?

The least number that will answer this question is twelve; for if we suppose that each Grace gave one to each Muse, the latter would each have three, and there would remain three for each Grace. (Any multiple of 12 will answer the conditions of the question.)

The Jesuitical Teacher.

A TEACHER, having fifteen young ladies under her care, wished them to take a walk each day of the week. They were to walk in five divisions of three ladies each, but no two ladies were to be allowed to walk together twice during the week. How could they be arranged to suit the above conditions?

SUN.			MON.			TUE.			WED.			THU.			FRI.			SAT.		
a	b	c	a	d	g	a	k	n	a	e	l	a	h	o	a	f	p	a	i	m
d	e	f	b	e	h	b	l	o	b	f	m	b	i	p	b	d	n	b	g	k
g	h	i	c	m	p	c	f	i	c	g	n	c	d	k	c	h	l	c	e	o
k	l	m	f	k	o	d	h	m	d	i	o	e	m	n	e	i	k	d	l	p
n	o	p	i	l	n	e	g	h	h	k	p	f	g	l	g	m	o	h	f	n

Atithmetical Puzzle.

If from 6 you take 9, and from 9 you take 10; and if 50 from 40 be taken, there will just half a dozen remain.

ANSWER.

From SIX	From IX	From XL
Take IX	Take X	Take L
S	I	X Rems.

The money game.

A PERSON having in one hand a piece of gold, and in the other a piece of silver, you may tell in which hand he has the gold, and in which the silver, by the following method: Some value, represented by an even number, such as 8, must be assigned to the gold; and a value represented by an odd number, such as three, must be assigned to the silver; after which, desire the person to multiply the number in the right hand by any even number whatever, such as 2, and that in the left by an odd number as 3; then bid him add together the two products, and if the whole sum be odd, the gold will be in the right hand, and the silver in the left; if the sum be even, the contrary will be the case,

To conceal the artifice better, it will be sufficient to ask whether the sum of the two products can be halved without a remainder; for in that case the total will be even, and in the contrary case odd.

It may be readily seen, that the pieces, instead of being in the two hands of the same person, may be supposed to be in the hands of two persons, one of whom has the even number, or piece of gold, and the other the odd number, or piece of silver. The same operations may then be performed in regard to these two persons, as are performed in regard to the two hands of the same person, calling the one privately the right, and the other the left.

The philosopher's pupils.

TO find a number of which the half, fourth, and seventh added to three shall be equal to itself.

This was a favourite problem among the ancient Grecian arithmeticians, who stated the question in the following manner: "Tell us, illustrious Pythagoras, how many pupils frequent thy school?" "One half," replied the philosopher, "study mathematics, one fourth natural philosophy, one seventh observe silence, and there are three females besides."

The answer is, 28 : $14+7+4+3=28$.

To discover a square number.

A SQUARE number is a number produced by the multiplication of any number into itself; thus, 4 multiplied by 4 being the square root from which it springs. The extraction of the square root of any number takes some time; and after all your labour you may perhaps find that the number is not a square number. To save this trouble, it is worth knowing that every square number ends either with a 1, 4, 5, 6, or 9, or with two cyphers, preceded by one of these numbers.

Another property of a square number is, that if it be divided by 4, the remainder, if any, will be 1—thus, the square of five is 25, and 25 divided by 4 leaves a remainder of 1; and again, 16, being a square number, can be divided by 4 without leaving a remainder.

The Sheepfold.

A FARMER had a pen made of 50 hurdles, capable of holding 100 sheep only: supposing he wanted to make it sufficiently large to hold double that number, how many addional hurdles would he have occasion for?

Answer.—Two. There were 24 hurdles on each side of the pen; a hurdle at the top. and another at the bottom; so that, by moving one of the sides a little back, and placing an additional hurdle at the top and bottom, the size of the pen would be exactly doubled.

Countrywoman and eggs.

A COUNTRYWOMAN carried eggs to a garrison, where she had three guards to pass. She sold to the first guard half the number she had, and half an egg more; to the second, the half of what remained, and an half egg besides; and to the third guard she sold the half of the remainder, and half another egg. When she arrived at the market-place, she had three dozen still to sell; how was this possible, without breaking any of the eggs? It would seem at the first view that this is impossible, for how can half an egg be sold without breaking any of the eggs? The possibility of all this seeming impossibility will be evident, when it is considered, that by taking the greater half of an odd number, we take the exact half $+\frac{1}{2}$. When the countrywoman passed the first guard she had 295 eggs; by selling to that guard 148, which is the half $+\frac{1}{2}$, she had 147 remaining; to the second guard she disposed of 74, which is the major half of 147; and, of course, after selling 37 out of 74 to the last guard, she had still three dozen remaining.

How to rub out twenty chalks at five times, rubbing out every time an odd one.

TO do this trick, you must make twenty chalks, or long strokes, upon a board as in the margin:

Then begin and count backwards, as 20, 19, 18, 17, rub out these four; then proceed saying, 16, 15, 14, 13, rub out these four; and begin again, 12, 11, 10, 9, and rub out these; and proceed again, 8, 7, 6, 5, then rub out these; and lastly say, 4, 3, 2, 1, when these four are rubbed out. The whole twenty are rubbed out at five times, and every time an odd one, that is, 17th, 13th, 9th, 5th, and 1st.

This is a trick which, if once seen, may be easily returned; and the puzzle at first is, it not occurring immediately to the mind to begin to rub them out backwards. It is as simple as anything possibly can be.

1 ——
2 ——
3 ——
4 ——
5 ——
6 ——
7 ——
8 ——
9 ——
10 ——
11 ——
12 ——
13 ——
14 ——
15 ——
16 ——
17 ——
18 ——
19 ——
20 ——

Odd or even.

EVERY odd number multiplied by an odd number produces an odd number; every odd number multiplied by an even number produces an even number; and every even number multiplied by an even number also produces an even number. So, again, an even number added to an even number, and an odd number added to an odd number, produce an even number; while an odd an even number added together produce an odd number.

If any one holds an odd number of counters in one hand, and an even number in the other, it is not difficult to discover in which hand the odd or even number is. Desire the party to multiply the number in the right hand by an even number, and that in the left hand by an odd number, then to add the two sums together, and tell you the last figure of the product, if it is even, the odd number will be in the right hand; and if odd, in the left hand; thus, supposing there are 5 counters in the right hand, and 4 in the left hand, multiply 5 by 2, and 4 by 3, thus: $5\times2=10$, $4\times3=12$, and then adding 10 to 12, you have $10+12=22$, the last figure of which, 2, is even, and the odd number will consequently be in the right hand.

The old woman and her eggs.

AT a time when eggs were scarce, an old woman who possessed some remarkably good-laying hens, wishing to oblige her neighbours, sent her daughter round with a basket of eggs to three of them; at the first house, which was the squire's, she left half the number of eggs she had and half a one over; at the second she left half of what remained and half an egg over; and at the third she again left half of the remainder, and half a one over; she returned with one egg in her basket, not having broken any. Required—the number she set out with. *Ans.* 15 eggs.

The figures, up to 100, arranged so as to make 505 in each column, when counted in ten columns perpendicularly and the same when counted in ten files horizontally.

10	92	93	7	5	96	4	98	99	1
11	19	18	84	85	86	87	13	12	90
71	29	28	77	76	75	24	23	22	80
70	62	63	37	36	35	34	68	69	31
41	52	53	44	46	45	47	58	59	60
51	42	43	54	56	55	57	48	49	50
40	32	33	67	65	66	64	38	39	61
30	79	78	27	26	25	74	73	72	21
81	89	88	14	15	16	17	83	82	20
100	9	8	94	95	6	97	3	2	91

Each of these files, when added up, makes 505.

The dice guessed unseen.

A pair of dice being thrown, to find the number of points on each die without seeing them. Tell the person who casts the die to double the number of points upon one of them, and add 5 to it then to multiply the sum produced by 5, and to add to the product the number of points upon the other die. This being done, desire him to tell you the amount, and, having thrown out 25, the remainder will be a number consisting of two figures the first of which, to the left, is the number of points on the first die, and the second figure, to the right, the number on the other. Thus;

Suppose the number of points of the first die which comes up to be 2, and that of the other 3; then, if to four, the double of the points of the first, there be added 5, and the sum produced, 9, be multiplied by 5, the product will be 45; to which, if 3, the number of points on the other die, be added, 48 will be produced, from which, if 25 be subtracted, 23 will remain; the first figure of which is 2, the number of points on the first die, and the second figure 3, the number on the other.

The Sovereign and the Sage.

A sovereign being desirous to confer a liberal reward on one of his courtiers who had performed some very important service, desired him to ask whatever he thought proper, assuring him it should be granted. The courtier, who was well acquainted with the science of numbers, only requested that the monarch would give him a quantity of wheat equal to that which would arise from one grain doubled sixty-three times successively. The value of the reward was immense; for it will be found by calculation that the sixty-fourth term of the double progression divided by 1, 2, 4, 8, 16, 32, &c., is 9223372036854775808. But the sum of all the terms of a double progression, beginning with 1, may be obtained by doubling the last term, and subtracting from it 1. The number of the grains of wheat, therefore, in the present case, will be 18446744073709551615. Now, if a pint contain 9216 grains of wheat, a gallon will contain 73728; and, as eight gallons make one bushel, if we divide the above result by eight times 73728 we shall have 31274997411295 for the number of the bushels of wheat equal to the above number of grains, a quantity greater than the whole surface of the earth could produce in several years, and which in value would exceed all the riches, perhaps on the globe.

December and May.

AN old man married a young woman; their united ages amounted to C. The man's age multiplied by 4 and divided by 9, gives the woman's age. What were their respective ages?

ANSWER.—The man's age, 60 years 12 weeks; the woman's age, 30 years 40 weeks.

The Mathematical Fortune Teller.

PROCURE six cards, and having ruled them the same as the following diagrams, write in the figures neatly and legibly.

It is required to tell the number thought of by any person, the numbers being contained in the cards, and such numbers not to exceed 60. How is this done?

3	5	7	9	11	1
13	15	17	19	21	23
25	27	29	31	33	35
37	39	41	43	45	47
49	51	53	55	57	59

5	6	7	13	12	4
14	15	20	21	22	23
28	29	30	31	36	37
52	38	39	44	45	46
47	53	54	55	60	13

9	10	11	12	13	8
14	15	24	25	26	27
28	29	30	31	40	41
42	43	44	45	46	47
56	57	58	59	60	13

3	6	7	10	11	2
14	15	18	19	22	23
26	27	30	31	34	35
38	39	42	43	46	47
50	51	54	55	58	59

17	18	19	20	21	16
22	23	24	25	26	27
28	29	30	31	48	49
50	51	52	53	54	55
56	57	58	59	30	60

33	34	35	36	37	32
38	39	40	41	42	43
44	45	46	47	48	49
50	51	52	53	54	55
56	57	58	59	60	41

Request the person to give you the cards containing the number, and then add the right hand upper corner figures together, which will give the correct answer. For example: suppose 10 is the number thought of, the cards with 2 and 8 in the corners will be given, which makes the answer 10, and so on with the others.

The knowing Shepherd.

A SHEPHERD was going to market with some sheep, when he met a man who said to him, "Good morning, friend, with your score." "No," said the shepherd. "I have not a score; but if I had as many more, half as many more, and two sheep and a half, I should have just a score." How many sheep had he?

He had 7 sheep: as many more 7; half as many more, 3½; and 2½; making in all 20.

The certain game.

TWO persons agree to take, alternately numbers less than a given number, for example, 11, and to add them together till one of them has reached a certain sum such as 100. By what means can one of them infalliably attain to that number before the other?

The whole artifice in this consists in immediately making choice of the numbers, 1, 12, 23, 34, and so on, or of a series which continually increases by 11, up to 100. Let us suppose that the first person, who knows the game, makes choice of 1; it is evident that his adversary, as he must count less than 11, can at most reach 11, by adding 10 to it. The first will then take 1, which will make 12 and whatever number the second may add the first will certainly win, provided he continually add the number which forms the complement of that of his adversary to 11; that is to say, if the latter take 8, he must take 3; if 9 he must take 2; and so on. By following this method he will infalliably attain to 89, and it will then be impossible for the second to prevent him from getting first to 100; for whatever number the second takes he can attain only to 99; after which the first may say—"and 1 make 100." Between two persons who are equally acquainted with the game, he who begins must necessarily win.

The magical century.

IF the number 11 be multiplied by any one of the nine digits, the two figures of the product will always be alike, as appears in the following example:—

11	11	11	11	11	11	11	11	11
1	2	3	4	5	6	7	8	9
11	22	33	44	55	66	77	88	99

Now, if another person and yourself have fifty counters a-piece, and agree never to stake more than ten at a time, you may tell him that if he permit you to stake first, you always complete the even century before him.

In order to succeed, you must first stake 1, and remembering the order of the above series, constantly add to what he stakes as many as will make one more than the numbers 11, 22, 33, &c., of which it is composed, till you come to 89, after which your opponent cannot possibly reach the even century himself, or prevent you from reaching it.

If your opponent has no knowledge of numbers, you may stake any other number first, under 10, provided you subsequently take care to secure one of the last terms, 56, 67, 78, &c.; or you may even let him stake first, if you take care afterwards to secure one of these numbers.

This exercise may be performed with other numbers, but, in order to succeed, you must divide the number to be attained by a number which is a unit greater than what you can stake each time, and the remainder will then be the number you must first stake. Suppose, for example the number to be attained be 52 (making use of a pack of cards instead of counters), and that you are never to add more than 6; then, dividing 52 by 7, the remainder, which is 3, will be the number which you must first stake; and whatever your opponent stakes, you must add as much to it as will make it equal to 7, the number by which you divided, and so in continuation.

The unlucky hatter.

A PERSON went into a hatter's shop and bought a hat for a sovereign and gave in payment a five-pound note. The hatter called on a friend near by, who changed the note for him, and the man having received his change went his way. Shortly afterwards the tailor's friend discovered the note to be a counterfeit, and called upon the hatter, who was compelled forthwith to borrow five-pounds of another friend to redeem it with; so the forged note was left on the hatter's hands. The question is, what did he lose —was it five-pounds beside the hat or was it five-pounds including the hat?

This question is often given with names and circumstances as a real transaction, and if the company knows such persons so much the better, as it serves to withdraw attention from the question; and in almost every case the first impression is, that the hatter lost five-pounds besides the hat, though it is evident he was paid for the hat, and had he kept the sovereign he needed only to have borrowed four-pound additional to redeem the note.

The basket of nuts.

A PERSON remarked that when he counted over his basket of nuts, two by two, three by three, four by four, five by five, or six by six, there was one remaining; but when he counted them by sevens, there was no remainder. How many had he?

The least common multiple of 2, 3, 4, 5, and 6 being 60, it is evident, that if 61 were divisible by 7, it would answer the conditions of the questions. This not being the case, however let $60\times2+1$, $60\times3+1$, $60\times4+1$, &c., be tried successively, and it will be found that $301=60+5+1$, is divisible by 7; and consequently this number answers the conditions of the question. If to this we add 420, the least common multiple of 2, 3, 4, 5, 6 and 7, the sum 721 will be another answer; and by adding perpetually 420, we may find as many answers as we please.

The united digits.

ARRANGE the figures 1 to 9 in such order that, by adding them together they amount to 100.

$$\begin{array}{r} 15 \\ 36 \\ 47 \\ \hline 98 \\ 2 \\ \hline 100 \end{array}$$

Quaint Questions.

WHAT is the difference between twenty four quart bottles, and four and twenty quart bottles?

Ans.—56 quarts difference.

What three figures, multiplied by 4, will make precisely 5?

Ans.—$1\frac{1}{4}$, or 1·25.

What is the difference between six dozen dozen, and half-a-dozen dozen?

Ans.—792: Six dozen dozen being 864 and half-a-dozen dozens, 72.

Place three sixes together, so as to make seven.

Ans.—$6\frac{6}{6}$.

Add one to nine and make it twenty.

Ans.—IX—cross the *I*, it makes XX.

Place four fives so as to make six and a half. *Ans.* $5\frac{5}{5}\cdot5$

A room with eight corners had a cat in each corner, seven cats before each cat, and a cat on every cat's tail. What was the total number of cats? *Ans.* Eight cats.

Prove that seven is the half of twelve. *Ans.*—Place the Roman figures on a piece of paper, and draw a line through the middle of it, the upper will be VII.

The council of ten.

TEN cards or counters, numbered from one to ten, or the first ten playing cards of any suit disposed in a circular form may be employed with great convenience for performing this feat. The accompanying figure shows the cards thus arranged, number one, or the ace, designated by A. and the ten by K.

3
C
2 B D 4
1 A E 5
10 K F 6
9 I G 7
H
8

Having placed the cards in the above order, desire a bystander to think of a card or number, and when he has done so, to touch any other card or number. Request him then to add to the number of the card touched the number of the cards employed, which in this case is ten. Then desire him to count the sum in an order contrary to that of the natural numbers, beginning at the card he touched, and assigning it the number of the card he thought of. By counting in this manner, he will end at the number or card he thought of, and consequently you will immediately know it.

Thus, for example, suppose the person had thought of 3 C, and touched 6 F; then, if 10 be added to 6, the sum will be 16; and if that number be counted from F, the number touched, towards E D B C A, and so on, in the retrograde order, counting F three, the number thought of, E five, D six, and so round to sixteen, that number will terminate at C, showing that the person thought of 3, the number which corresponds to C.

A greater or less number of cards or counters may be employed at pleasure; but in every instance the whole number of cards must be added to the number of the card touched.

This trick done on the dial of a watch, using the figures thereon, is even more surprising.

The two Travellers.

Two travellers trudged along the road together,
Talking, as travellers do, about the weather;
When, lo! beside their path the foremost spies
Three casks, and loud exclaims "A prize, a prize!"
One large, two small, but all of various size.
This way and that they gazed, and all around.
Each wondering if an owner might be found:
But not a soul was there—the coast was clear,
So to the barrels they at once drew near,
And both agree whatever may be there
In friendly partnership they'll fairly share.
Two they find empty, but the other full,
And straightway from his pocket one doth pull
A large clasp knife. A heavy stone lay handy,
And thus in time they found their prize was brandy.
'Tis tasted and approved; their lips they smack,
And each pronounces 'tis the famed Cognac.
"Won't we have many a jolly night, my boy!
May no ill luck our present hopes destroy!"
'Twas fortunate one knew the mathematics,
And had a smattering of hydrostatics;
Then measured he the casks, and said, "I see
This is eight gallons, those are five and three."
The question then was how they might divide
The brandy, so that each should be supplied
With just four gallons, neither less nor more.
With eight, and five, and three they puzzle sore,
Filled up the five—filled up the three, in vain:
At length a happy thought came o'er the brain
Of one; 'twas done, and each went home content,
And their good dames declared t'was excellent.
With those three casks they made division true;
I found the puzzle out, say, friend, can you?

The five-gallon barrel was filled first, and from that the three-gallon barrel, thus leaving two gallons in the five-gallon barrel; the three-gallon barrel was then emptied into the eight-gallon barrel, and the two gallons poured from the five-gallon barrel into the empty three-gallon barrel; the five-gallon barrel was then filled, and one gallon poured into the three-gallon barrel, therefore leaving four gallons in the five-gallon barrel, one gallon in the eight-gallon barrel, and three gallons in the three-gallon barrel, which was then emptied into the eight-gallon barrel. Thus each person had four gallons of brandy in the eight and five-gallon barrels respectively.

The Fox, Goose and Corn.

A countryman having a Fox, a Goose, and a peck of Corn, came to a river, where it so happened that he could carry but one over at a time. Now as no two were to be left together that might destroy each other, he was at his wit's end, for says he "Though the corn can't eat the goose, nor the goose eat the fox; yet the fox can eat the goose, and the goose eat the corn." How shall he carry them over, that they shall not destroy each other?

Let him first take over the Goose, leaving the Fox and Corn; then let him take over the Fox and bring the Goose back; then take over the Corn; and lastly take over the Goose again.

The visitors to the Crystal Palace.

IN a family consisting of 8 young people, it was agreed that 3 at a time should visit the Crystal Palace, and that the visit should be repeated each day as long as a different trio could be selected. In how many days were the possible combinations of 3 out of 8 completed?

We must multiply $8 \times 7 \times 6$, and also $3 \times 2 \times 2$, and divide the product of the former, 336, by the product of the latter, 6; the result is 56, the number of visits, a different three going each time. So much gratified were they with the results of their agreement, that they wished to be allowed another series of visits, to be continued as many days as they could group 3 together in different order when starting. If Paterfamilias had granted such permission he would have had to wait 56 multiplied by $3 \times 2 \times 1$, or 336 days, before this "new series" of visits would have come to a *finis*.

How many changes can be given to 7 notes of a piano?

THAT is to say, in how many ways can 7 keys be struck in succession, so that there shall be some difference in the order of the notes each time?

The result of multiplying

$$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

is 5,040, the number of changes.

The Arithmetical Triangle.

THIS name has been given to a contrivance said to have originted with the famous Pascal, or to have been perfected by him.

1							
2	1						
3	3	1					
4	6	4	1				
5	10	10	5	1			
6	15	20	15	6	1		
7	21	35	35	21	7	1	
8	28	56	70	56	28	8	1
&c.				&c.			

This peculiar series of numbers is thus formed: Write down the numbers 1, 2, 3, &c., as far as you please, in a vertical row. On the right hand of 2 place 1, add them together, and place 3 under the 1; then 3 added to 3=6, which place under the 3; 4 and 6 are 10, which place under the 6, and so on as far as you wish. This is the second vertical row, and the third is formed from the second in a similar way. This triangle has the property of informing us, without the trouble of calculation, how many combinations can be made, taking any number at a time out of a larger number.

Suppose the question were that just given; how many selections can be made of 3 at a time out of 8? On the horizontal row commencing with 8, look for the third number; this is 56, which is the answer.

How many different deals can be made with 13 cards out of 52.

TO discover this we must make a continued multiplication of $52 \times 51 \times 50 \times 49 \times 48 \times 47 \times 46 \times 45 \times 44 \times 43 \times 42 \times 41 \times 40$, being 13 terms for the 13 cards, also a continued multiplication of $13 + 12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$, and, having found the two products, we must divide one by the other, and the quotient is the number of different deals out of 52 cards. This "sum," that looks so formidable with natural figures, is a very short one by logarithms.

The Three Graces.

THREE articles, or three names inscribed on cards, having been distributed between three persons, you are to tell which article or card each person has.

Designate three persons in your own mind, as 1st, 2d, and 3d, and the three articles, A, E, I. Provide 24 counters, and give 1 to the first person, 2 to the 2d 3 to the 3d. Place the remaining 18 on the table. Request that the three persons will distribute among themselves the three articles, and, that, having done so, the person who has the one which you have secretly denoted by A, will take as many counters as he may have already; the holder of E must take twice as many as he may have; and the holder of I must take four times as many. Then leave the room, in order that the distribution of articles and of counters may be made unobserved by you. We will suppose that the three articles are three cards, on which are the words Clara, Rosa, Emily, which you will yourself secretly denote by the letters A, E, I. Suppose also that in the division the first person has Emily (I), the second has Clara (A), and the third has Rosa (E), then the 1st will take four times as many counters as he has (1), and will therefore take 4; the 2d will take as many as he has (2), and will therefore take 2; the 3d will take 6, being twice as many as he has (3). On the table will be left six counters. The distribution having been made, you will return and observe the number of counters on the table, from which you can find who is the holder of each card by the following method.

It is plain that if the cards held by the 1st and 2d can be told, that held by the 3d will be known. It will be found that only six numbers can remain, viz. 1. 2, 3, 5, 6. 7, never four, and never more than 7. Now the 6 combinations of a, e, and i, here given, represent the articles held by the 1st and 2d persons.

1	2	3	4	5	6	7
ae	ea	ai	—	ei	ia	ie

In the case supposed, 6 counters being on the table, the combination *ia* indicates that the first person has the card you have called I (Emily), the 2d has A (Clara), so that the 3d has E (Rosa),

In order to recollect the combinations of A, E, and I, it will be best to keep in memory some 7 words which form a sentence, and which contain these vowels in the order just given.

Ouryoung friends can amuse themselves in forming a sentence for themselves, but as examples we supply three.

1	2	3	4	5	6	7
ae	*ea*	*ai*	—	*ei*	*ia*	*ie*
James	easy	admires	now	reigning	with a	bride
Anger,	fear,	pain	may	be hid	with a	smile
Graceful	Emma,	charming	she	reigns	in all	circles

Or, if they prefer Latin, they can use the pentameter made up by the inventor of this beautiful pastime:

1	2	3	5	6	7
Salve	certa	animae	semita	vita	quies.

Another Method.

THE performer must mentally distinguish the articles by the letters A, B, C, and the persons as 1st, 2d, and 3d. The persons having made their choice give 12 counters to the 1st, 24 to the 2d, and 36 to the 3d. Then request the 1st person to add together the half of the counters of the person who has chosen A, the 3d of the person who has chosen B, and the 4th of those of the person who has chosen C, and then ask the sum, which must be either 23, 24, 25, 27, 28, or 29, as in the following table,

First.	Second.	Third.	
12	24	36	
A	B	C	23
A	C	B	24
B	A	C	25
C	A	B	27
B	C	A	28
C	B	A	29

This table shows that if the sum be 25, for example, the 1st person must have chosen B, the 2d A, and the 3d C; or if it be 28 the 1st must have chosen B, the 2d C, and the 3d A.

Another Method.

THREE things having been divided between three persons, you are to determine the holder of each.

Call the persons in your mind 1st, 2d, 3d.

Give to the 1st a card on which you have written the number 12; to the 2d the number 24; to the 3d 36.

The three things you denote as A, E, I.

To simplify it you may have three cards with a name upon each, of which the initial letters are A, E, I, as Anna, Emma, Isabel.

Request your friends to divide between them the three articles, and then to add together certain parts of the numbers on their cards, as follows:

Whoever has A must supply one half of the number on his card;

Whoever has E must supply one-third; whoever has I must supply one-fourth.

This half, third, and fourth having been added together, the sum must be announced to you on your return; and from this number you can tell who has A, who has E, and who has I.

If the No. is	the 1st has	the 2nd has	the 3rd has
23	A	E	I
24	A	I	E
25	E	A	I
27	I	A	E
28	E	I	A
29	I	E	A

The sum which will be given to you can be one of six only. There are only six ways in which the articles can be divided, and there is a definite number for each of them.

The number 26 can never occur, and to recollect the six which do occur, and which you perceive are consecutive, you need take note only of what the 1st and 2nd persons have.

23	24	15	26	27	28	29
ae	*ai*	*ea*	—	*ia*	*ei*	*ie*

If you make up a line of good (or bad) English, having the vowels in the order here given, you will find it will aid you in their recollection. We give one as a specimen:

ae *ai* *ea* — *ia* *ei* *ie*

Brave, dashing sea, like a giant revives itself.

The United Digits.

ON page eleven we showed how to place the figures, 1 to 9, so that they might by adding them together amount to 100. Until now it has been believed that there was only one way to do this without using fractions. We give another:

$$
\begin{array}{r}
32 \\
57 \\
\hline
89 \\
6 \\
4 \\
1 \\
\hline
100.
\end{array}
$$

To Tell what Figure a Person has struck out of the Sum of Two given Numbers.

ASSUME those numbers only that are divisible by 9; such, for instance, as 18, 36, 63, 81, 117, 126, 162, 261, 315, 360, 891, &c. Ask a person to choose any two of these numbers, and after adding them together in his mind, strike out from the sum any one of the figures he pleases. Then desire him to tell you the sum of the remaining figures; and it follows that the number which you are obliged to add to this amount, to make it 9 or 18, is the one he struck out. Thus:

Suppose he choose the numbers 117 and 360, making together 477, and that he strike out the centre figure, the two other figures will, added together, produce 11, which, to make 18, requires 7, the number struck out.

Dividing the Beer.

During the siege of Sebastopol, when the troops were on 'short allowance,' a can of eight pints of porter was ordered to be equally divided between two messes: but having only a five pint can, and one that held three pints, it was found impossible to make this division, till one of the clever sappers suggested the following method; and, to understand it, we will put down the contents of each of three cans at each stage of the process; commencing with:

	8 pts	5 pts	3 pts
The 8-pint can full, and the others empty - - -	8	0	0
1. Filled the 5-pint can - -	3	5	0
2. Filled the 3-pint can from the 5-pint - - - -	3	2	3
3. Pour the contents of 3-pint with the 8-pint - -	6	2	0
4. Transfer the 2-pints from the 5-pints to the 3-pint -	6	0	2
5. Fill the 5-pint from the 8-pint - - - -	1	5	2
6. Fill up the 3-pint from the 5-pint - - - -	1	4	3
7. Pour the 3-pints into the 8-pint, completing - -	4	4	0

This was a dexterous expedient feat of the worthy sapper, the only objections to it being the time the thirty men had to wait, and the resulting flat condition of the beer.

The Difficult Case of Wine.

A GENTLEMAN had a bottle containing 12 pints of wine, 6 of which he was desirous of giving to a friend, but he had nothing to measure it with, except 2 other bottles, one of 7 pints and the other of 5. How did he contrive to put 6 pints into the 7-pint bottle?

	12-pt.	7-pt.	5-pt.
Before he commenced, the contents of the bottles were	12	0	0
1. He filled the 5-pint	7	0	5
2. Emptied the 5-pint into the 7-pint	7	5	0
3. Filled again the 5-pint from the 12-pint	2	5	5
4. Filled up the 7-pint from the 5	2	7	3
5. Emptied the 7-pint into the 12-pint	9	0	3
6. Poured the 3 pints from the 5 into the 7	9	3	0
7. Filled the 5-pint from the 12-pint	4	3	5
8, Filled up the 7-pint from the 5-pint	4	7	1
9. Emptied the 7-pint into the 12-pint	11	0	1
10. Poured 1 pint from the 5-pint into the 7-pint	11	1	0
11. Filled the 5-pint from the 12-pint	6	1	5
12. Poured the contents of the 5-pint into the 7-pint	6	6	0

The wine and the tables.

A CERTAIN hotel-keeper was dexterous in contrivances to produce a large appearance with small means. In the dining-room were three tables, between which he could divide 21 bottles, of which 7 only were full, 7 half full, and 7 apparently just emptied, and in such a manner that each table had the same number of bottles, and the same quantity of wine. He did this in two ways.

Table	Full	Half-full	Empty.
1	2	3	2
2	2	3	2
3	3	1	3

Table	Full	Half-full	Empty.
1	3	1	3
2	3	1	3
3	1	5	1

He also performed a similar exploit with 24 bottles, 8 full, 8 half-full, and 8 empty.

Table	Full	Half-full	Empty.
1	3	2	3
2	3	2	2
3	2	4	3

Table	Full	Half-full	Empty.
1	2	4	2
2	2	4	2
3	4	0	4

Also with 27 bottles, 9 full, 9 half-ful, and 9 empty:

Table	Full	Half-full	Empty.
1	2	5	2
2	3	3	3
3	4	1	4

Table	Full	Half-full	Empty.
1	1	7	1
2	4	1	4
3	4	1	4

The three Travellers.

THREE men met at a caravansary or inn, in Persia; and two of them brought their provisions along with them according to the custom of the country; but the third not having provided any, proposed to the others that they should eat together, and he would pay the value of his proportion. This being agreed to, A produced 5 loaves, and B 3 loaves, all of which the travellers ate together, and C paid 8 pieces of money as the value of his share, with which the others were satisfied, but quarrelled about the division of it. Upon this the matter was referred to the judge, who decided impartially. What was his decision?

At first sight it would seem that the money should be divided according to the bread furnished; but we must consider that, as the 3 ate 8 loaves, each one ate $2\frac{2}{3}$ loaves of the bread he furnished. This from 5 would leave $2\frac{1}{3}$ loaves furnished the stranger by A; and $3-2\frac{2}{3}=\frac{1}{3}$ furnished by B, hence $2\frac{1}{3}$ to $\frac{1}{3}=7$ to 1, is the ration in which the money is to be divided. If you imagine A and B to furnish, and C to consume all, then the division will be according to amounts furnished.

Which counter has been thought of out of sixteen.

TAKE sixteen pieces of card, and number them 1 to 16. Arrange them in two rows, as at A B.

A	B	C	B	D	M	E	B	F	N	G	B	H
1	9	1	9	2	2	2	9	4	2	2	9	6
2	10	3	10	4	4	6	10	8	6	1	10	5
3	11	5	11	6	6	1	11	3	1	4	11	8
4	12	7	12	8	8	5	12	7	5	3	12	7
5	13		13		1		13		4		13	
6	14		14		3		14		8		14	
7	15		15		5		15		3		15	
8	16		16		7		16		7		16	

Desire the person to think of one of the umbers, and to tell you in which row it is. Suppose he fixes on 6; he will tell you that the row A contains the number he thought of.

Take up the row A, and arrange the numbers on each side of the row B, as shown at C D, so that the first number of the row A may be the first of the row C, the second of A be the first of D. the third of A be the second of C, and so on.

Ask in which of the rows, C or D, is the number thought of; in the case supposed it is in D.

Take up the rows C D, and put one underneath the other as at M, taking care that the half-row in which is the number thought of, shall be above the other.

Divide it again into two rows, as at E F, on each side of B, in the same way as before. Ask again in which row it is; it is now in E.

Place one row under the other, as at N, and divide again into two rows, which which will now be as G H,

You will be informed that the number is in row H, and you may then announce it to be the top number of that row.

The number thought of will always be *at the top of one of the rows after three transpositions.* If there were 32 counters it would be at the top after four transpositions.

Curious Properties of some figures.

SELECT any two numbers you please, and you will find that one of the two, their amount when added together, or their difference, is always three, or a number divisible by 3.

Thus, if the numbers are 3 and 8, the first number is 3; let the numbers be 1 and 2, their sum is 3; let them be 4 and 7, the difference is 3. Again 15 and 22, the first number is divisible by 3; 17 and 26, their difference is divisible by 3, &c.

All the odd numbers above 3, that can only be divided by 1, can be divided by 6, by the addition or subtraction of a unit. For instance, 13 can only be divided by 1; but after deducting 1, the remainder can be divided by 6; for example 5+1=6; 7—1=6; 17+1=18; 19—1 =18; 25—1=24, and so on.

If you multiply 5 by itself, and the quotient again by itself, and the second quotient by itself, the last figure of each quotient will always be 5. Thus 5×5=25; 25×25=125; 125×125=625, &c. Again, if you proceed in the same manner with the figure 6, the last figure will constantly be 6; thus, 6×6=36; 36×36=216; 216×216=1,296, and so on.

To multiply by 2 is the same as to multiply by 10 and divide by 5.

Any number of figures you may wish to multiply by 5, will give the same result if divided by 2—a much quicker operation than the former; but you must remember to annex a cipher to the answer where there is no remainder, and where there is a remainder, annex a 5 to the answer. Thus, multiply 464 by 5, the answer will be 2320; divide the same number by 2, and you have 232, and as there is no remainder you add a cipher. Now, take 357 and multiply by 5—the answer is 1785. On dividing 357 by 2, there is 178 and a remainder; you therefore place 5 at the right of the line, and the result is again 1785.

There is something more curious in the properties of the number 9. Any number multiplied by 9 produces a sum of figures which, added together, continually makes 9. For example all the first multiples of 9, as 18, 27, 36, 45, 54, 63, 72, 81 sum up 9 each. Each of them multipled by any number whatever produces a similar result; as 8 times 81 are 648, these added together make 18, 1 and 8 are 9. Multiply 648 by itself, the product is 419, 904—the sum of these digits is 27, 2 and 7 are 9. The rule is invariable. Take any number whatever and multiply it by 9; or any multiple of 9, and the sum will consist of figures which, added together continually number 9. As 17×18=306, 6 and 3 are 9; 117×27=3,159, the figures sum up to 18, 8 and 1 are 9; 4591×72=330,552, the figures sum up to 18, 8 and 1 are 9. Again, 87,363×54=4,717,422; added together, the product is 27, or 2 and 7 are 9, and so always. If any row of two or more figures be reversed and subtracted from itself, the figures composing the remainder, will, when added horizontally, be a multiple of nine:

42	886	326
24	688	1623
—	—	——
19—8×2.	198—9×2.	1638—9×2

If a multiplicand be formed of the digits in their regular order, omitting the 8, a multiplier may be found by a rule, which will give a product, each figure of which shall be the same. Thus if 12345679 be given, and it be required to find a multiplier which shall give the product all in 2, that multiplier will be 18; if in 3, the multiplier will be 27; if all 4, it will be 36—and so forth.

12345679	12345679	12345679
18	27	36
98765432	86419753	74074074
12345679	24691358	37037037
222222222	333333333	444444444

The rule by which the multiplier is discovered, (but which we do not attempt to explain) is this: Multiply the last figure (the 9) of the multiplicand by the figure of which you wish the product to be composed, and that number will be the required multiplier. Thus, when it was required to have the product composed of 2, the 2, multipied by 9 gives 18, the multiplier; 3 multiplied by 9 gives 27, the multiplier gives the product in 3; &c.

If a figure with a number of ciphers attached to it, be divided by 9, the quotient will be composed of one figure only, namely, the first figure of the dividend, as—

9)600,000	9)40,000
66,6666—6	4,444—4

If any sum of figures can be divided by 9 as, 9)549 / 61 the amount of these figures, when added together, can be divided by 9:—thus, 5, 4, 9, added together, make 18, which is divisible by 9. If the sum 549 is multiplied by any figure, the product can also be divided by 9, as—

549
6
9)3294
366

And the amount of the figures of the product can also be divided by 9; thus,

3
2
9
4
2)18
9

To multiply by 9, add a cipher, and deduct the sum that is to be multiplied: thus,

43,260
4,326
38,934

Produces the same result as

4,326
9
38,934

In the same manner, to multiply by 99 add two ciphers; by 999, three ciphers, &c. These properties of the figure 9 will enable the young arithmetician to perform an amusing trick, quite sufficient to excite the wonder of the uninitated.

Any series of numbers that can be divided by 9, as 365,472,821,754, &c., being shown, a person may be requested to multiply secretly either of these series by any figure he pleases, to strike out one number of the quotient, and to let you know the figures which remain, in any order he likes; you will then, by the assistance of the knowledge of the above properties of 9, easily declare the number which has been erased. Thus, suppose 365,472 are the numbers chosen, and the multiplier is six; if then, 1 is struck out, the number returned to you will be

365472
6
219232

2
1
9
2
3
2
19

The amount of these numbers is 19; but 19, divided by 9, leaves a remainder of 1; you, therefore, want 1 to complete another 9: 8, then, is the number erased.

The component figures of the product made by the multiplication of every digit into the number 9, when added together, make NINE.

The order of these component figures is reversed after the said number has been multiplied by 5.

The component figures of the amount of the multipliers (viz. 45,) when added together, make NINE.

The amount by the several products, or multiplies of 9, gives for a quotient, 45; that is, 4+5=NINE.

The amount of the first product (viz. 9) when added to the other product, whose respective component figures make 9, is, 81; which is the square of NINE.

The said number 81, when added to the above mentioned amount of the several products, or multiples of 9 (viz. 405) make 486, which, if divided by 9, gives for a quotient 54: that is, 5+4=NINE.

It is also observable, that the number of changes that may be rung on nine bells is 362,880; which figures, added together make 27; that is, 2+7=NINE.

And the quotient of 362,880, divided by 9, will be 40,320; that is 4+0+3+2+0 =NINE.

If the number 37 be multiplied by any of the progressive numbers arising from the multiplication of 3 with any of the units, the *figures* in the quotient will be similar, and the result may be known beforehand by merely inspecting the progressive numbers, thus, 3,6,9,12,15,18,21, 24,27, &c., are the progressive numbers formed by 3 multiplied by the units 1 to 9; and the result of the multiplication of any of these numbers with 37 may be seen in following examples :—$37 \times 3 = 111$; $37 \times 6 = 222 \times 37 \times 12 = 444$; $37 \times 24 = 888$; by which in appears that the numbers of which the quotient is formed are the same as the units, by which number 3 was multiplied to obtain the respective progressive numbers. Thus—3 multiplied by 2 is equal to 6, and 37 multiplied by 9 is equal to 222; so, again, 4 multiplied by 3 produces 12, and 37 multiplied by 12 is equal to 444, and so on.

The industrious Frog.

THERE was a well 30 feet deep, and, at the bottom, a frog anxious to get out. He got up 3 feet per day, but regularly fell back 2 feet at night. Required the number of days necessary to enable him to get out?

The frog appears to have cleared one foot per day, and at the end of 27 days, he would be 27 feet up, or within 3 feet of the top, and the next day he would get out. He would therefore be 28 days getting out.

The Mathematical Blacksmith.

A BLACKSMITH had a stone weighing 40 lbs. A mason coming into the shop, hammer in hand, struck it and broke it into four pieces. "There," says the smith, "you have ruined my weight." "No," says the mason, "I have made it better, for whereas you could before weigh but 40 lbs. with it, now you can weigh every pound from 1 to 40." Required—size of the pieces?

Ans. 1, 3, 9, 27; for in any geometrical series proceeding in a triple ration, each term is 1 more than twice the sum of all the preceding, and the above series might proceed to any extent. In using the weights, they must be put in one or both scales, as may be necessary; as for example, to weigh 2, put 1 in one scale, and 3 in the other.

The Doctor and his Pupils.

OLD Dr. Brazenose took a school, and had four and twenty boys as boarders. These he placed in dormitories thus :—

3	3	3
3		3
3	3	3

So that there were nine boys on each side of the establishment, while the worthy doctor occupied the centre chamber himself. Strange to say, however, despite the old gentleman's eagle eye, it was suspected the boys were in the habit of slipping out after dark four at a time. One night the doctor resolved to find out all about it. So, after he imagined the four had departed, he made a round of the rooms. Much to his astonishment, however, there were still nine on each side in this way :—

4	1	4
1		1
4	1	4

The four boys who went out brought back four chums from a neighbouring academy who, against all rules, remained for the night. Nevertheless, the doctor on his next round could only find nine boys to a side. This is how the young rascals managed it :—

2	5	2
5		5
2	5	2

By and by four more chums arrived, and stole up to the dormitories on tiptoe; but when the watchful dominie again paid the corridors a visit, there were still but nine to a side (though eight extra boys were present) thus :—

1	7	1
7		7
1	7	1

Four more lads, missing their companions, now went to the opposite academy in search of them, and they, too, entered unperceived. Twelve strange youths were now the guests of Dr. Brazenose's four and twenty pupils, yet when the doctor, hearing an unwonted talking and laughing, stole out to discover the cause of the strange voices, the number to a side was still the same, in this fashion:—

	9	
9		9
	9	

Next night Dr. Brazenose's boys slipped out in a body of six, leaving their fellow-pupils behind disposed in their rooms thus:—

5		4
4		5

But that night the doctor discovered the secret, and henceforward the nocturnal games were put a stop to. It will be seen that the old boy's mistake lay in counting each corner room twice.

The Seven Apple Women.

SEVEN women sat at their apple-stalls. The first had twenty apples, the second forty, the third sixty, the fourth eighty, the fifth a hunded, the sixth a hundred and twenty, the seventh a hundred and forty. All sold their apples at the same rate, and when their stocks were disposed of, every one had taken exactly the same sum. What were the rate at which the apples were sold ?

Answer.—Seven a penny and threepence a piece for all that were over..

20=two pennyworth + 6 threepences =20d.

40=five pennyworth + 5 threepences =20d.

60=eight pennyworth+4 threepences =20d.

80=eleven pennyworth+3 threepences =20d.

100 = fourteen pennyworth + 2 threepences=20d.

120=seventeen pennyworth+1 threepence=20d.

140=twenty pennyworth=20d.

The Farmer's Sons.

A WELL-TO-DO farmer died, and left his property to his three sons in shares. The eldest son was to have one half as his share, the second a third, and the third a ninth. All went well till they began to divide the live-stock, when it was found there were seventeen cows upon the farm, and over these the brothers began to squabble. It would hardly do to slaughter the animals for they were of an exceedingly fine breed ; still they could not see how else the division was to be accomplished. In their quandary they applied to an old friend of their father.

This gentleman thought for a time, and then an idea struck him.

"Take one of my cows," said he, "it originally belonged to your own herd, and I fancy we can manage it."

The cow was brought over to the farm and now as there were eighteen, the division was accomplished.

The eldest got	9 cows
The second	6
The third	2
	17

So, you see, their old friend got back his cow after all.

The Shepherds.

TWO shepherds were feeding their flocks on the mountain-side. Said

one to the other, "Jack, give me one of your sheep, and I shall have as many as you."
"Nay, "replied the other greedily, "Give me one of yours and I shall have *as many again* as you,
How many sheep had each?
The first had five, the second had seven

The Ten Tens.

TAKE ten pieces of card, and upon each write any ten words; there is no restriction as to the initial letter of nine of the words, but the last word on each card must commence with certain letters which you must in your own mind associate with the numbers 1 to 10, so that by knowing the initial letter of the last word on each card, you can determine its number.

Here are ten cards, (call these the *Selecting Cards*), which we give by way of example, though our readers will perhaps prefer having words of their own selection.

Jane.	Ellen.	George.	James	Newton.
Mary.	Fanny	William	Clement.	Davy.
Matilda.	Caroline.	Frederick.	Edward.	Morse.
Sarah.	Isabel.	Robert.	Ralph.	Fulton.
Rosa.	Flora.	Edmund.	Francis.	Franklin.
Elizabeth.	Laura.	John.	Edwin.	Arago.
Harriet.	Maria.	Alfred.	Walter.	Spurzheim.
Ann.	Frances.	Albert.	Charles.	Laplace.
Emily.	Edith.	Henry.	Samuel.	Steers.
Emma.	**D**orothea.	**I**saac.	**T**heodore.	**H**erschel.

Sister.	Rose.	Friendship.	Putnan.	Clay.
Brother.	Violet.	Happiness.	Lafayette.	Webster.
Uncle.	Lupin.	Industry.	Steuben.	Calhoun.
Aunt.	Daisy.	Ambition.	Scott.	Benton.
Grandmother.	Tulip.	Energy.	Taylor.	Jefferson.
Grandfather.	Peony.	Fidelity.	Green.	Adams.
Nephew.	Hyacinth.	Affection.	Harrison.	Madison.
Niece.	Pink.	Hope.	Hamilton,	Jackson.
Cousin.	Snowdrop.	Justice.	Wayne.	Monroe.
Father.	**L**ily	**O**rder.	**W**ashington	**N**apoleon.

For these the key words are, "Edith Flown," so that the letters

	E	D	I	T	H	F	L	O	W	N
Stand for	1	2	3	4	5	6	7	8	9	10

For the success of the game, the key words and the numbers denoted by their letters, must be carefully concealed.

Take ten other cards, which call the "*grouped cards*" and upon one write down the first word from each of the selecting cards, being careful to write them in the same order. Let another card contain all the words which are second from the top, and so on till all the words have been grouped together. As an example, we give the 1st and 4th grouped cards.

1st.	4th.
Jane.	Sarah.
Ellen.	Isabel.
George.	Robert.
James.	Ralph.
Newton.	Fulton.
Sister.	Aunt.
Rose.	Daisy.
Friendship.	Ambition.
Putman.	Scott.
Clay.	Benton.

The object of the game is to guess which of the words from any of the *selecting cards* any person may have fixed upon.

Let any one choose a card out of the *selecting cards*, and after he has fixed upon a word, give it back to you; when receiving it, carefully note the last word upon it, which will give you, by the aid of the key word, the number of the card; this you must keep secret, and you then give him all the *grouped cards*, and request him to show you the cards which contain the words he fixed upon.

You can then announce the word, for the number of the word from the top on the grouped card is the same as the number of the selecting card, from which he made his choice.

Suppose he made his choice from the card which has Theodore for its last word —this is No. 4; when he shows you the grouped card, which he says contains the selected word, you will know that Ralph, the fourth from the top, is the name he fixed upon.

Both Ways Right.

ARRANGE the figures from 1 to 100 in such a way that they may count 505 in either file or column,

This peculiar feat is accomplished thus:—

10	92	93	7	5	96	4	98	99	1
11	19	18	84	85	86	87	13	12	90
71	29	28	77	76	75	24	23	22	80
70	62	63	37	36	35	34	68	69	31
40	52	53	44	46	45	47	58	59	61
51	42	43	54	56	55	57	48	49	50
41	32	33	67	65	66	64	38	39	60
30	79	78	27	26	25	74	73	72	21
81	89	88	14	15	16	17	83	82	20
100	9	8	94	95	6	93	3	2	91

Napier's Rods.

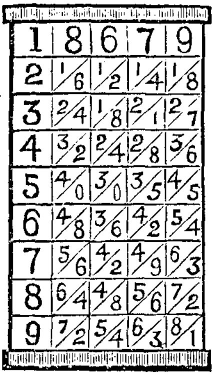
THE object of this contrivance is to render arithmetical multiplication more easy, and to secure its correctness; it was much used by astronomers before the invention of logarithms.

To appreciate the merits of this invention, we must consider the process of multiplication as usually performed. Suppose we had to multiply 8,679 by 8:

```
8,679
    8
-----
69,432
```

We first multiply 9 by 8=72, and putting down 2 as the first figure in the product, carry the 7 to add to the next product of 7 by 8=56; this gives us 63, and 3 being put down as the second figure; 6 is carried to add to the product of 6 by 8, and so on.

A blunder may be made in each part of this process; for 1st, we may reckon 8 times 9 as some other number than 72; 2d, after multiplying the 7 by the 8, we might add to the resulting 56 some other figure than the 7, which we carried; 3d, we may add 56 to seven inaccurately,



making some other sum of it than the right one, 63. Errors in a long multiplication problem are usually made in one of these three ways, and to prevent such errors, Lord Napier* introduced this useful contrivance. Thin strips of card, wood or bone, 9 times as long as they are broad, are each divided into 9 equal shares, a figure is printed or written on the top square, and in each of these squares underneath is the product of multiplying that figure by 2, 3, 4, &c. up to 9.

To use these in multiplication, select the strips, the top figures of which make the number to be multiplied. For example :

To multiply 8,679 by 8, look at the eighth line of squares from the top, and on that line will be found the product of each of the integers 8, 6, 7, 9, when multiplied by 8. We have then to write down the 2 as the first figure of the product add 7 and 6 together=13 ; write 3 as the next figure, carry 1 to add to the sum of 8 and 5, and so on.

The reason for dividing the figures in each square by a diagonal line, and for placing the left hand figure higher than the right is, that the eye may be thus assisted in adding the carried figure of one slip to the unit of the next.

To provide for the occurrence of more than one of the same figures in the multiplicand, there should be several slips or rods for each of the digits.

In practice the rods are placed on a flat piece of wood, with two ridges at right angles, by which they are preserved in a proper position.

This instrument can be made useful in "divisions," by making by means of it a table of the product of the divisor, multiplied by each of the numbers 1 to 9.

* Ancestor of the fighting and writing Napier's of later days.

Magic Squares.

Observe the figures in this square.

THE 64 numbers are so arranged in the 64 squares as to produce the sum of 260 in each of the lines. This arrangement has also other remarkable qualities. Each group of 8 numbers standing in a circle around the centre of the diagram amounts to 260. There are six such circles ; the smallest consists of the numbers 22. 28, 38, 44, 19, 29, 35, and 45 ; the largest of 8, 10, 56, 58, 1, 15, 49, and 63. The sum of the 4 centre numbers, plus the four corner numbers, is 260 ; and the diagonal cross of 8 numbers in the middle of the board sums 260. An enthusiast will discover other qualities.

18	63	4	61	6	59	8	41
49	32	51	14	53	12	39	10
2	47	36	45	22	27	24	57
33	16	35	46	21	28	55	26
31	50	29	20	43	38	9	40
64	17	30	19	44	37	42	7
15	34	13	52	11	54	25	56
48	1	62	3	60	5	58	23

To discover two or more numbers that a person has thought of.

1st Case.—Where each of the numbers is less than 10, Suppose the numbers thought of were 2, 3, 5.

EXAMPLE.

1. Desire him to double the first number making - - - - - - 4
2. To add 1 to it - - - - - 5
3. To multiply by 5 - - - - 25
4. To add the second number - 28

There being a third number, repeat this process—

5. To double it - - - - 56
6. To add 1 to it - - - - 57
7. To multiply by 5 - - - 285
8. To add the third number - - 290

Andt o proceed in the same manner for as many numbers as were thought of. Let him tell you the last sum produced (in this case 290). Then, if there were two numbers thought of, you must substract 5; if three, 55; if four, 555. You must here substract 55, leaving a remainder of 235, which are the numbers thought of, 2, 3 and 5.

2d Case.—Where one or more of the numbers are 10, or more than 10, and where there is an *odd* number of numbers thought of.

Suppose he fixes upon five numbers viz. 4, 6, 9, 15, 16.

He must add together the numbers as follows, and tell you the various sums.

1. The sum of the 1st and 2d - - 10
2. The sum of the 2d and 3d - - 15
3. The sum of the 3d and 4th - - 24
4. The sum of the 4th and 5th - - 31
5. The sum of the 1st and last - - 20

You must then add together the 1st, 3d, and 5th sums, viz. 10+24+20=54, and the 2d and 4th, 15+31=46; take one from the other, leaving 8. The half of this is the 1st number, 4; if you take this from the sum of the 1st and 2d you will have the 2d number, 6; this taken from the sum of the 2d and 3d will give you the 3d, 9; and so on for the other numbers.

3d Case.—Where one or more of the numbers are 10, or more than 10, and where an *even* number or numbers has been thought of.

Suppose he fixes on six numbers, viz. 2, 6, 7, 15, 16, 18. He must add together the numbers as follows, and tell you the sum in each case:—

1. The sum of the 1st and 2d - - 8
2. The sum of the 2d and 3d - - 13
3. The sum of the 3d and 4th - - 22
4. The sum of the 4th and 5th - 31
5. The sum of the 5th and 6th - 34
6. The sum of the 2d and last - 24

You must then add together the 2d, 4th and 6th sums, 13+31+24=68, and the 3d and 5th sums, 22+34=56, Subtract one from the other, leaving 12; the 2d number will be 6, the half of this; take the 2d from the sum of the 1st and 2d you will get the 1st; take the 2d from the sum of the 2d and 3d, and you will have the 3d, and so on.

How many counters have I in my hand.

A PERSON having an equal number of counters in each hand, it is required to find how many he has altogether.

Suppose he has 16 counters, or 8 in each hand. Desire him to transfer from one hand to the other a certain number of them, and to tell you the number so transferred. Suppose it be 4, the hands now contain 12. Then ask him how many times the smaller number is contained in the larger; in this case it is 3 times. You must then multiply the number transferred, 4, by the 3, making 12, and add the 4, making 16; then divide 16 by the 3 *minus* 1; this will bring 8, the number in each hand.

In most cases fractions will occur in the process; when 10 counters are in each hand, and if four be transferred, the hands will contain 6 and 14.

He will divide 14 by 6 and inform you that the quotient is $2\frac{2}{6}$ or $2\frac{1}{3}$.

You multiply 4 by $2\frac{1}{3}$, which is $9\frac{1}{3}$.

Add 4 to this, making $13\frac{1}{3}$, equal to $\frac{40}{3}$.

Subtract one from $2\frac{1}{3}$, leaving $1\frac{1}{3}$ or $\frac{4}{3}$.

Divide $\frac{40}{3}$ by $\frac{4}{3}$, giving 10, the number in each hand,

The Mysterious Halvings.

To tell the number a person has thought of.

ONE of the company must fix upon any numbers from 1 to 15; this he keeps secret, as well as the numbers produced by the succeeding operations:

Suppose he fixes on - - - - - 8
He must add 1 to it, making - - 9
Triple it - - - - - - - - - - 27
Halve it*—1st *halving*—(*larger half*) 14
Triple it - - - - - - - - - 42
Halve it—2d *halving* - - - - 21
Triple it - - - - - - - - - 63
Halve it—3d *halving*—(*larger half*) 32
Triple it - - - - - - - - - 96
Halve it—4th *halving* - - - - 48

He need not inform you that 48 is the figure produced, but he must let you know in which four halvings he was obliged to take a "larger half;" having ascertained this point, you discover the

*When an exact half cannot be taken without a fraction, he must take the larger half—you must tell him this before he commences. Here it is the larger half number fixed upon in the following manner. Carry in your mind, or on a slip of paper, the following list of names in which the letter A occurs in one or more of the three syllables of all except the last.

The three syllables are intended to represent the 1st, 2d, and 3d halvings, and the occurrence of the letter A corresponds to the occurrence of a "larger half" in one or more of these three halvings. Having been informed where the *larger half* was taken, refer to the word which has A in the corresponding syllable and against it stand two numbers, one of which was the number thought of; and of these two, the right hand number is the correct one *if a larger half was taken in the 4th stage*, and the left hand one *if the 4th halving was exact.*

In the example given, a *larger half* occurred in the 1st and 3d stage; this points us to *Car-ro-way*, and the halving in the 4th stage being exact, shows us that 8 was the number fixed upon.

	If the 4th halving is *exact*.	If a *larger half* occurs in the 4th halving.
WAsh-ing-ton	4	12
LA-fAy-ette	2	10
CAr-row-wAy	8	0
MAn-hAt-tAn	6	14
Ger-m-Any	13	5
Tel-e-grAph	3	11
Bo-nA-pArte	1	9
Long-fel-low	15	7

It will be observed that there is always a difference of 8 between the numbers of the columns, so that it is necessary to recollect only one of them. Perhaps some of our readers who wish to be adepts in this game, would prefer recollecting the above table if put in this form:

2-3	1-2	3	1-2-3	1-3	2	none
1	2	3	4	8	13	15

where the upper line denotes the cases in which the "larger half" was taken, and the lower line the numbers of the left hand column above given,

Another Method.

The person having chosen any number from one to fifteen, he is to add one to that number, and triple the amount. Then,

1st. He is to take half of that triple, and triple that half.

2nd. To take the half of the last triple and triple that half.

3rd. To take the half of the last triple.

4th. To take the half of the last half.

In this operation there are four distinct cases or stages where the half is to be taken. The three first are denoted by one of the eight following Latin words, each word being composed of three syllables, and the syllables containing the letter *i* corresponding in numerical order with the cases where the half cannot be taken without a fraction; consequently, in those cases the person who makes the deduction is to add one to the number to be divided. The fourth case shows which of the two numbers corresponding to each word has been chosen. For if the fourth half can be taken without adding one, the number chosen is in the first, or left-hand column; but if not, it is in the second column to the right.

The words.	The numbers denoted.	
Mi-ser-is	8	0
Ob-tin-git	1	9
Ni-mi-um	2	10
No-tar-i	3	11
In-fer-nos	4	12
Or-di-nes	13	5
Ti-mi-di	6	14
Te-ne-ant	15	7

Example.—Suppose the number chosen to be nine, to which is to be added one, making ten, and which last, being tripled gives thirty. Then:

1st case.	The half of the triple is which tripled, makes	15 45
2nd case	The half of that triple, 1 being added to make an even number, is and that tripled makes	23 69
3rd case.	The half of the last triple, 1 being added, is	35
4th case.	The half of the last half, 1 being again added, is	18

Here we see, that in the second and third case, one had to be added and, looking at the table, we find that the only corresponding word having an *i* in its second and third syllables is *Ob-tin-git*, which represents the figures one and nine. Then, as one had to be added in the fourth case, we know by the rule, that the figure in the second column, 9, is the one required. Observe, that if no addition be required at any of the four stages, the number thought of will be fifteen; and if one addition only be required at the fourth stage, the number will be seven.

Odd Magic Squares.

SQUARES of this kind are formed thus. Imagine an exterior line of squares above the magic square you wish to form, and another exterior line on the right hand of it. These two imaginary lines are shown in the figure.

Then attend to the two following rules:

1st. In placing the numbers in the squares we must go in the ascending oblique direction from left to right; any number which, by pursuing this direction, would fall into the exterior line, must be carried along that line of squares, whether vertical or horizontal, to the last square. Thus, 1 having been placed in the centre of the top line, (see the first table, 2 would fall into the exterior square above the fourth vertical line; it must be therefore carried down to the lowest square of that line; then, ascending obliquely, 3 falls in the square, but four falls out of it, to the end of a horizantal line, and it must be carried along that line to the extreme left, and there placed. Resuming our oblique ascension to the right, we place 5, where the reader sees it, and would place 6 in the middle of the top band, but finding it occupied by 1, we look for the direction to the

	18	25	2	9	
17	24	1	8	15	17
23	5	7	14	16	23
4	6	13	20	22	4
10	12	19	21	3	10
11	18	25	2	9	

30	39	48	1	10	19	28
38	47	7	9	18	27	29
46	6	8	17	26	35	37
5	14	16	25	34	36	45
13	15	24	33	42	44	4
21	23	32	41	43	3	12
22	31	40	49	2	11	20

2d Rule, which prescribes that, when in ascending obliquely we come to a square already occupied, we must place the number, which according to the first rule should go into that occupied square, directly under the last number placed. Thus, in ascending with 4, 5, 6, the 6 must be placed directly under the 5, because the square next to 5 in oblique direction is "engaged."

Magic squares of this class, however large in the number of compartments, can be easily filled up by attending to these two rules.

The Arithmetical Boomerang.

THE boomerang is an instrument of peculiar form, used by the natives of New South Wales, for the purpose of killing wild fowl and small animals. If projected forwards, it at first proceeds in a straight line, but afterwards rises in the air, and after performing sundry peculiar gyrations, returns in the direction of the place whence it was thrown.

The term is applied to those arithmetical processes by which you can divine a number thought of by another. You throw forwards the number by means of addition and multiplication, and then, by means of subtraction and division, you bring it back to the original starting point making it proceed in a track so circuitous as to evade the superficial notice of the tyro.

To find a number thought of.

First Method.

THIS is an arithmetical trick which. to those who are unacquainted with it, seems very surprising; but, when explained it is very simple. For instance, ask a person to *think* of any number under 10. When he says he has done so, desire him to treble that number. Then ask him whether the sum of the number he has thought of (now multiplied by 3) be odd or even; if odd, tell him to add 1 to make the sum even. He is next to halve the sum, and then treble that half. Again ask whether the amount be odd or even If odd, add 1, (as before) to make it even and then halve it. Now ask how many nines are contained in the remainder. The secret is, to bear in mind whether the first sum be odd or even; if odd, retain 1 in the memory; if odd a second time, retain 2 more (making in all 3 to be retained in the memory;) to which add 4 for every nine contained in the remainder.

For example, No. 7 is odd the first and also the second time; and the remainder (17) contains one nine: so that 1, added to 2, make 3, and 3, added to 4, make 7, the number thought of. No. 1 is odd the first time (retain 1), and even the second (of which no notice is taken), but the remainder is not equal to nine. No. 2 is even the first and odd the second time (retain 2), but the remainder contains no nine. No. 3 is odd the first and the second time, still there is no nine in the remainder. No. 4 is even both times, and contains one nine. No. 5 is odd the first time and the remainder contains one nine. No. 6 is odd the second time, and contains one nine in the remainder. No. 8 is even both times, and the remainder contains two nines. No notice need be taken of any overplus of a remainder, after being divided by nine.

The following are illustrations of the result with each number:

1	2	3	4	5	6	7	8	9
3	3	3	3	3	3	3	3	3
—	—	—	—	—	—	—	—	—
3	2)6	9	2)12	15	2)18	21	2)24	27
Add 1	—	Add 1	—	Add 1	—	Add 1	—	Add 1
—	3	—	6	—	9	—	12	—
2)4	3	2)10	3	2)16	3	2)22	3	2)28
—	—	—	—	—	—	—	—	—
2	9	5	2)18	8	27	11	2)36	14
3	Add 1	3	—	3	Add 1	3	—	3
—	—	—	9)9	—	—	—	9)18	—
2)6	2)10	15	—	2)24	2)28	33	—	2)42
—	—	Add 1	1	—	—	Add 1	2	—
3	5	—		9)12	9)14	—		9)21
		2)16		—	—	2)34		—
		—		1	1	—		2
		8				9)17		
						—		
						1		

Second Method.

EXAMPLE.

Let a person think of a number, say	6
1. Let him multiply it by 3 - -	18
2. Add 1 - - - - -	19
3. Multiply by 3 - - - -	57
4. Add to this the number thought of	63

Let him inform you what is the number produced; it will always end with 3. Strike off the 3, and inform him that he thought of 6.

Third Method.

EXAMPLE.

Suppose the number thought of to be	6
1. Let him double it - - - -	12
2. Add 4 - - - - - -	16
3. Multiply by 5 - - - - -	80
4. Add 12 - - - - - -	92
5. Multiply by 10 - - - -	920

Let him inform you what is the number produced. You must in every case subtract 320; the remainder is, in this example, 600; strike off the two ciphers, and announce 6 as the number thought of.

Fourth Method.

Desire a person to think of a number, say 6. He must then proceed—

EXAMPLE.

1. To multiply this number by itself 36
2. So take 1 from the number thought of - - - - - - - 5
3. To multiply this by itself - - 25
4. To tell you the difference between this product and the former - - 11

You must then add 1 to it - - 12
And halve this number - - - 6
Which will be the number thought of.

Fifth Method.

Desire a person to think of a number, say 6. He must then proceed as follows:

EXAMPLE.

1. Add 1 to it - - - - - - 7
2. Multiply by 3 - - - - - 21
3. Add 1 again - - - - - 22
4. Add the number thought of - 28

Let him tell you the figures produced (28):

5. You then substract 4 from it - 24
6. And divide by 4 - - - - 6

Which you can say is the number thought of.

Sixth Method.

EXAMPLE.

Suppose the number thought of - 6

1. Let him double it - - - - 12
2. Desire him to add to this any number you tell him, say 4 - - - - 16
3. To halve it - - - - - 8

You can then tell him that if he will subtract from this the number he thought of, the remainder will be, in the case supposed, 2.

Note.—The remainder is always half of the number you tell him to add.

Who wears the ring.

THIS is an elegant application of the principles involved in discovering a number fixed upon. The number of persons participating in the game should not exceed nine. One of them puts a ring on one of his fingers, and it is your object to discover—1st, The wearer of the ring. 2d. The hand. 3d. The finger. 4th. The joint.

The company being seated in order the persons must be numbered 1, 2, 3, &c.; the thumb must be termed the first finger, the fore finger being the second; the joint nearest the extremity must be called the first joint; the right hand is one, and the left hand two.

These preliminaries having been arranged, leave the room in order that the ring may be placed unobserved by you. We will suppose that the third person has the ring on the right hand, third finger, and first joint; your oblect is to discover the figures 3131.

Desire one of the company to perform secretly the following arithmetical operations:

1, Double the number of the person who has the ring; in the case supposed, this will produce....................6
2. Add 5......................11
3. Multiply by 5................55
4. Add 10.....................65
5. Add the number denoting the hand 66
6. Multiply by 10..............660
7. Add the number of the finger..663
8. Multiply by 10..............6630
9. Add the number of the joint..6631
10. Add 35...................6666

He must apprise you of the figures now produced, 6666; you will then in all cases substract from it 3535; in the present instance there will remain 3131, denoting the person No. 3, the hand No, 1, the finger No. 3, and the joint No. 1.

The Astonished Farmer.

A and B took each 30 pigs to market; A sold his at three for a pound, B at two for a pound, and together they received 25 pounds. A afterwards took 60 alone, which he sold as before, at five for two pounds, and received but 24 pounds; what became of the other pound?

This is rather a catch question, the insinuation that the first lot were sold at the rate of five for two pounds being only true in part. They commence selling at that rate, but, after making ten sales, A's pigs are exhausted, and they have received 20 pounds; B still has ten, which he sells at "two for a pound," and of course receives five pounds; whereas had he sold them at the rate of five for two pounds, he would have received but four pounds. Hence the difficulty is easily settled.

HOW TO TELL A PERSON'S AGE.

YOUNG ladies of a marriageable age do not like to tell how old they are, but you can find out by following the subjoined instructions. Let the person whose age is to be discovered do the figuring. Suppose, for example, that her age is fifteen, and that she was born in August. Let her put down the number of the month in which she was born, and tell her to proceed as follows :—

Number of month - -	8
Multiply by 2 - -	16
Add 5 - - - -	21
Multiply by 50 - -	1050
Then add the age (15) -	1065
Subtract 365, leaving -	700
Add 115 - - - -	815

She then announces the result 815, whereupon you inform her that her age is fifteen, and August, or the eighth month, is the month of her birth, for the two figures to the right in the result will always indicate the age, and the remaining figure or figures the month the birthday falls in. This rule never fails for all ages up to one hundred. In ages under ten a cypher will appear in the result, but no account is taken of this.

The Market Woman's Puzzle.

A MARKET-WOMAN bought 120 apples at two a halfpenny, and 120 more of another sort at three for a halfpenny; but not liking her bargain, she mixed them together, and sold them out again at five for a penny, thinking she would get the same sum; but on counting up her money, she found, to her surprise, that she had lost twopence. How did this happen?

On the first view of the question there does not appear to be any loss; but if it be supposed that in selling five apples for a penny she gave three of the latter sort, viz: those at three for a halfpenny, and two of the former, viz: those at two for a halfpenny, she would receive just the same money as she bought them for; but this will not be throughout the whole, for admitting that she sells them as above, it must be evident that the latter stock would be exhausted first, and consequently she must sell as many of the former as remained overplus at five for a penny, which she bought at the rate of two for a halfpenny, or four for a penny, and would therefore lose. It will be readily found that when she had sold all the latter sort in the above manner, she would only have sold eighty of the former, for there are as many threes in one hundred and twenty as twos in eighty; then the remaining forty must be sold at five for a penny, which were bought at the rate of four for a penny, viz:—

	A : D : : A : D	
If	4 : 1 : : 40 : 10	Prime cost of 40 of the first sort.
	5 : 1 : : 40 : 8	Selling price of ditto.
	2	Pence Loss.

The Drover's Problem.

One morning I chanced with a drover to meet,
Who was driving some sheep up to town,
Which seemed very near ready to drop from the heat,
Whereupon I exclaimed with a frown:

"Don't you think it is wrong to treat animals so,
Why not take better care of your flock?"
"I would do so," said he, "but I've some miles to go
Between this and eleven o'clock."

"Well, supposing you have," I replied, "you should let
Them have rest now and then by the way."
"So I will, my good friend, if you think I can get
There in time for the market to-day.

"Now, as you seem to know such a lot about sheep,
Perhaps you'll tell us how many I've got?"
"No, a casual glance, as they stand in a heap,
Won't permit of it, so I cannot."

"Well, supposing as how I'd as many again,
Half as many, and seven, as true
As you're there, it would pay me to ride up by train,
Because I should have thirty-two."

There were ten sheep in the flock; ten, as many again; five, half as many; and seven besides. Total: thirty-two.

More Queer Questions.

IF you cut up thirty yards of cloth into one-yard pieces, and cut one yard off every day, how long will it take?

Ans: Twenty-nine days.

What two numbers multiplied together will produce 7?

Ans: 7 and 1.

What is the difference between twice 25 and twice 5 and 20?

Ans: Twice 25 is 50. Twice 5, and 20 is thirty—difference 20.

What is the two-thirds of three-fourths of elevenpence-halfpenny?

Ans: Five-pence three-farthings. The two-thirds of the three-fourths of anything are just one-half the whole.

How much is a third and half-a-third of five?

Ans: Two and a half. There are exactly three-thirds in five, therefore a third and half-a-third make exactly half.

Divide the number 50 into two such parts that, if the greater part be divided by seven, and the lesser multiplied by three, the sum of the quotient and the product will make 50?

Ans: 35 and 15.

If a goose weighs 10 lbs. and half its its own weight, what is the weight of the goose?

Ans: 20 lbs. 10 lbs., and 10 lbs. for half its own weight.

A snail climbing up a post 20 feet high, ascends five feet every day and slips down four feet every night. How long will it take to get to the top of the post?

Ans: 16 days. It is perhaps unnecessary to point out that the snail would gain one foot a day for 15 days, and on the 16th day reach the top of the pole, and there remain.

A train starts daily from San Francisco to New York, and one daily from New York to San Francisco, the journey lasting five days. How many trains will a traveller meet in journeying from New York to San Francisco?

Ans: Ten. About ninety-nine persons out of a hundred would say five trains, as a matter of course. The fact is overlooked that every day during the journey a fresh train is starting from the other end, while there are five trains on the way to begin with. Consequently the traveller will meet not five trains, but ten.

The unfair Division.

A GENTLEMAN rented a farm and contracted to give to his landlord two-fifths of the produce; but prior to the time of dividing the corn the tenant used 45 bushels. When the general division was made, it was proposed to give the landlord 18 bushels from the heap in lieu of his share of the 45 bushels which the tenant had used, and then to begin and divide the remainder as though none had been used. Would this method have been correct?

No. The landlord would lose seven and one-fifth bushels by such an arrangement, as the rent would entitle him to two-fifths of the 18. The tenant should give him 18 bushels from his own share after the division is completed, otherwise the landlord would only receive two-sevenths of the first 63 bushels.

To find six times thirteen in twelve.

PLACE your figures thus:—

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,

and taking always the first and last figure together, you say:—

1	and	12	make	13	6 times.
2	„	11	„	13	
3	„	10	„	13	
4	„	9	„	13	
5	„	8	„	13	
6	„	7	„	13	

Peculiar Properties of the Numbers 37 and 73.

THE number 37 being multiplied by each of the numbers in the arithmetical progression—3, 6, 9, 12, 15, 18, 21, 24, 27, all products will be composed of three similar figures, and the sum is always equal to the number by which 37 was multiplied:

37	37	37	37	37	37	37	37	37
3	6	9	12	15	18	21	24	27
111	222	333	444	555	666	777	888	999

The number 73 being multiplied by each of the afore-given progression, the products will terminate by one of the nine digits—1, 2, 3, 4, 5, 6, 7, 8, 9 in a reverse. Again, if we refer to the sums produced by the multiplication of 73 by 3, 6, 9, 12, and 15, it will be found that by reading the two figures to the left of each amount backwards, it will give 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

The Basket of Eggs.

A WOMAN carrying eggs to market was asked how many she had. She replied that when she counted them by twos there was one left! when by threes there was one left; and when by fours there was one left; but when she counted them by fives there were none left. How many had she?

The least number that can be divided by 2, 3, and 4 respectively, without a remainder, is twelve; and that there may be one remaining, the number must be 13; but this is not divisible by 5 without a remainder. The next greater number is 24, to which add 1, and it becomes 25; this is divisible by 5 without a remainder, and is therefore the number required.

A Tell-Tale Table.

THERE is a good deal of amusement in the following table of figures. It will enable you to tell how old the young ladies are. Just hand this table to a young lady and request her to tell you in which column or columns her age is contained, add together the figures at the top of the column in which her age is found, and you have the great secret. Thus, suppose her age to be seventeen, you will find that number in the first and fifth columns. Add the first figures of these columns and you have her age. Here is the magical table:—

1	2	4	8	16	32
3	3	5	9	17	33
5	6	6	10	18	34
7	7	7	11	19	35
9	10	12	12	20	36
11	11	13	13	21	37
13	14	14	14	22	38
15	15	15	15	23	39
17	18	20	24	24	40
19	19	21	25	25	41
21	22	22	26	26	42
23	23	23	27	27	43
25	26	28	28	28	44
27	27	29	29	29	45
29	30	30	30	30	46
31	31	31	31	31	47
33	34	36	40	48	48
35	35	37	41	49	49
37	38	38	42	50	50
39	39	39	43	51	51
41	42	44	44	52	52
43	43	45	45	53	53
45	46	46	46	54	54
47	47	47	47	55	55
49	50	52	56	56	56
51	51	53	57	57	57
53	54	54	58	58	58
55	55	55	59	59	59
57	58	60	60	60	60
59	59	61	61	61	61
61	62	62	62	62	62
63	63	63	63	63	63

To divide a number in two and have no remainder.

LET us suppose 8888. Run a line through the middle horizontally, and only ciphers will remain.

The Landlord Tricked.

TWENTY-ONE persons sat down to dinner at an inn, with the landlord at the head of the table. When dinner was finished, it was resolved that one of the number should pay the whole score; to be decided as follows:—A person should commence counting the company, and every seventh man was to rise from his seat, until all were counted out but one, who was to be the individual who should pay the whole bill. One of the waiters was fixed upon to count the company out, who, owing his master a grudge, resolved to make him the person who should have to pay. How must he proceed to accomplish this?—Commence with the sixth from the landlord.

To let a Person Select several Numbers out of a Bag, and to tell him the Number which shall exactly Divide the Sum of those he has chosen.

PROVIDE a small bag divided into two parts: into one of which put several tickets, numbering 6, 9, 15, 36, 63, 120, 213, 309, and any other number divisible by 3; and in the other part put as many other tickets marked with the No. 3 only. Ask any of the company to draw a handful of tickets from the first part, and, after showing them to the company, put them into the bag again; open it a second time, and desire anyone to take out as many tickets as he thinks proper. When he has done so, you open privately the other part of the bag, and tell him to take out of it one ticket only. You may safely pronounce that the ticket shall contain the number by which the amount of the other numbers is divisible; for as each of these numbers can be divided by 3, their sum total must evidently be divisible by that number.

A little ingenuity may diversify this feat by marking the tickets in one part of the bag with any numbers which are divisible by 9 only, the properties of both 9 and 3 being the same; and it should never be exhibited to the same company twice without being varied.

A Quibble.

WHAT is the difference between twenty four-quart bottles, and four-and-twenty quart bottles?

Fifty-six quarts difference; twenty four-quart bottles equals 80 quarts, from which deduct 24, there remains 56.

The Partial Reprieve.

TO arrange 30 criminals in such a manner, that by counting them in succession, always beginning again at the first, and rejecting every ninth person, 15 of them may be saved:

Arrange the criminals according to the order of the vowels in the following Latin verse:

4 5 2 1	3 1	1 2	2 3 1	3 2 1
Populeam	Virgam	Mater	Regina	Ferebat

Because O is the fourth in the order of the vowels, you must begin by four of those whom you wish to save; next to these place five of those whom you wish to punish, and so on alternately, according to the figures which stand over the vowels of the above verse.

The Cabbage Women.

THREE women went to market with cabbages, the first having 50 to sell, the second 30, the third no more than 10. All three sold out, and at the same rate, and each made the same sum of money by her cabbages. How were they sold?

Opening the market, cabbages were selling at 7 a penny, at which rate the first woman sold 49, and received sevenpence; the second sold 28, receiving fourpence; whilst the third sold a single pennyworth; she, however, had 3 cabbages remaining, whilst her companions had but 1 and 2 respectively. In the course of the day, the demand increasing, she advanced her price to threepence each, for which she sold her three last cabbages, and received ninepence. Her companions following her example, sold their remaining cabbages for threepence, each, and also realized the sum of tenpence. Thus:—

1st, for 49 cabbages, got	7d.	2nd, for 28 cabbages, got	4d.
and for 1 „	3d.	and for 2 „	6d.
50	10d.	30	10d.

3d. for 7 cabbages, got	1d.
and for 3 „	9d.
—10	—10d.

By Adding 5 to 6 to Make 9.

DRAW six vertical lines, and by adding five other lines to them, let the whole form nine.

I I I I I I

N I N E.

To Add a Figure to any given Number which shall render it Divisible by Nine.

Add the figures together in your mind which compose the number named; and the figure which must be added to the *sum produced, in order* to render it divisible by 9, is the one required.

Suppose the given number to be 4,623; add those together and 15 will be produced; now 15 requires 3 to render it divisible by 9, and that number, *three*, being added to 4,623, causes the same divisibility.

3

9)4,626

514

This exercise may be diversified by your specifying, before the sum is named, the particular place where the figure shall be inserted to make the number divisible by 9; for it is exactly the same thing whether the figure be put at the end of the number or between any two of its digits. Thus:—

9)46[3]23

5147

The Dinner Party.

A CLUB of seven persons agreed to dine together every day successively so long as they could sit down to table differently arranged. How many dinners would be necessary for that purpose? It may be easily found, by the rules of simple progression, that the club must dine together 5,040 times before they could exhaust all the arrangements possible, which would require above thirteen years.

An Expensive Navy.

IF you could buy a hundred ships, giving a farthing for the first, a halfpenny for the second, a penny for the third, twopence for the fourth, and so on to the last, doubling the sum each time, the whole amount paid would be £557,750, 707,053,344,041,463,074,442 18s. 7¾d.—a sum which in words runs thus: 557 quadrillions, 750,707 trillions, 53,344 billions, 41,463 millions, 74 thousand, 442 pounds, eighteen shillings and seven pence three farthings. This amount in sovereigns would weigh 3,557,083,590, 327,499,123,418 tons.

74. BOZEMAN BILL OF BIG BRACE, or Deadwood Dick's Corral
75. HUMBOLT HARRY THE HURRICANE, or Deadwood Dick Junior's Dog Detective
76. MOLL MYSTERY, or Deadwood Dick, Junior in Deadwood
77. PRINCE PISTOL, or Deadwood Dick, Junior's, Compact
78. MONTE CRISTO JUNIOR, or Deadwood Dick, Junior's, Inheritance
79. DEADWOOD DICK'S DELIVERANCE, or Fatal Footsteps
80. DEADWOOD DICK'S PROTEGEE, or Baby Bess the Girl Gold Miner
81. DEADWOOD DICK'S THREE, or the "Bellerin Bull" of Bismark
82. DEADWOOD DICK'S DANGER DUCKS, or the Owls of Oregan
83. DEADWOOD DICK'S DEATH HUNT, or the Way of the Transgressor
84. THE GHOULS OF GALVESTON, or Deadwood Dick in Texas
85. DEADWOOD DICK JUNIOR, THE WILD WEST VIDOCQ, or Leonora the Locator
86. DEADWOOD DICK ON HIS METAL, or Captain Crimson Cowl
87. *UNRAVELLING A TWISTED SKEIN, or Deadwood Dick in Gotham*
88. DEADWOOD DICK IN BOSTON, or the Cool Case
89. "RATS" THE BOY FERRET! or Deadwood Dick among the Crooks
90. THE ANARCHIST'S DAUGHTER, or Deadwood Dick in Chicago
91. DEADWOOD DICK AFLOAT, or the Prisoner of the Weird Isles
92. COOL KATE, or the Queen of Crooks. Deadwood Dick in Denver.
93. DEADWOOD DICK'S DECREE, or the Rise and Fall of "Jackpot" City
94. DEADWOOD DICK IN THE WEIRD RIVER BASIN. A Romance of Mount Mab
95. DEADWOOD DICK IN CONEY ISLAND, or the "Piping" of Polly Pilgrim
96. DEADWOOD DICK'S LEADVILLE LAY, or Bristol and Buckle's Boom
97. TURNING THE TABLES, or Deadwood Dick in Detroit
98. THE CLINCHER CAMPAIGN, or Deadwood Dick in Cincinnati
99. JIM JIMSON, the Preacher of Pokerville, or Deadwood Dick in Nevada
100. GOLCONDA THE GLADIATOR, or Deadwood Dick in No-Man's Land
101. SAWDUST SAM'S LAST GREEN GAME, or Deadwood Dick after the Queer
102. A RUM RACKET—4-11-44, or Deadwood Dick in Buffalo. A Mystery
103. A RACE FOR A RUTHLESS ROGUE, or Deadwood Dick's Chase across the Continent
104. DEADWOOD DICK AMONG THE SMUGGLERS, or Cleaning Out the Gulf Gang
105. DEADWOOD DICK'S INSURANCE CASE, or Carroling a Cunning Trio
106. THE MOUNTAIN AMAZON'S DOUBLE GAME, or Deadwood Dick back in the *Mines*
107. "GATHERED IN," or Deadwood Dick in Durango
108. *BOB WOOLF, THE BORDER RUFFIAN, or the Girl Dead-Shot*
109. CALIFORNIA JOE'S FIRST TRAIL. A Story of the Destroying Angels
110. JIM BLUDSOE, JUNIOR, THE BOY PHŒNIX
111. GILT-EDGED DICK, THE SPORT DETECTIVE, or the Road Agent's Daughter
112. BONANZA BILL, MINER, or Madam Mystery, the Female Forger
113. JACK HOYLE, THE YOUNG SPECULATOR, *or the Road to Fortune*
114. THE "SEA LANCE," or the Winged Witch of the Ocean
115. BOSS BOB AND HIS NONDESCRIPT PARD
116. CAPTAIN FOX, or Boss Bob's Boss Job
117. SOLID SAM, or the Branded Brows
118. CALIFORNIA JOE'S WAR TRAIL
119. DEADWOOD DICK'S DISCOVERY, or Found a Fortune
120. DEADWOOD DICK'S ADVENTURES IN "HONEYSUCKLE" TOWN
121. WATCH-EYE, THE SHADOW! By Deadwood Dick
122. DEADWOOD DICK AT DANGER DIVIDE, or Developing the Dead Secret
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128. NOBBY NICK OF NEVADA, or the Scamps of the Sierras
129. ANTELOPE ABE, THE BOY GUIDE
130. MUSTANG MERLE, THE YOUNG RANCHER
131. THE THREE SPOTTERS, or Running in the Rogues
132. THE STREET SPOTTERS' WEIRD HUNT
133. DANDY DICK, DETECTIVE
134. *DANDY DICK'S DOUBLE*
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138. DEADWOOD DICK IN JACKPOT, or Old Socdolager's Surprise Party
139. DEADWOOD DICK'S DISGUISE, *or The Curious Case at Coffin Camp*
140. DEADWOOD DICK'S DOMINOES, or the Rival Camp
141. MISSOURI JOE, THE WHITE TERROR, or the Scourge of the Laramie
142. DEADWOOD DICK'S DEPUTY, or Missouri Joe's Secret Trail
143. OLD AVALANCHE, the Great Annihilator
144. WILD EDNA, or Old Avalanche's Retaliation
145. BUCK TAYLOR, THE COMANCHE CAPTIVE, or Buckskin Sam to the Rescue
146. RUTH REDMOND, THE GIRL SHADOWER, or the Rivals of Buckskin
147. DAINTY LANCE, THE BOY SPORT, or the Bank Breakers' Decoy Duck
148. DEADWOOD DICK'S DOUBLE DEAL, or the All-Around Surprise
149. CYCLONE KIT, THE YOUNG GLAIATOR, or The Locked Valley
150. DEADWOOD DICK'S DEATHWATCH, or the Moving Mystery at Mexican Mustang
151. APOLLO BILL, THE TRAIL TORNADO
152. PANTHER PAUL, THE PRAIRIE PIRATE, or Dainty Lance to the Rescue

OTHERS IN ACTIVE PREPARATION.

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