TWELVE DAYS OF CHRISTMAS

Days of Christmas	Human Toes	Heads	Musical Instruments	Rings	Wings	Legs	Arms	Thumbs
1st								
2nd								
3rd								
4th								
5th								
6th								
7th								
8th								
9th								
10th								
11th								
12th								
Totals								

Using the information given in the song "The Twelve Days of Christmas" complete the table above. Add together the number of Heads, Days, Rings, Musical instruments, Wings, Legs, Arms and Thumbs and take the answer away from the number of Human toes. What is left?

C.B.A.

ROLL—A—COIN

A Roll-a-coin board consists of a lattice with a large number of squares, each of side 4 cm.

Ignoring the thickness of the sides of the squares, what is the probability of a coin of diameter 2 cm rolling into a position where it does not lie on a side?

D.I.B.

PAINTING BY NUMBERS

Find the values of the expressions in the various parts of the diagram. Colour those parts equal to 12 light green, those parts equal to 2 dark green, 5 brown, 6 blue and 10 white.
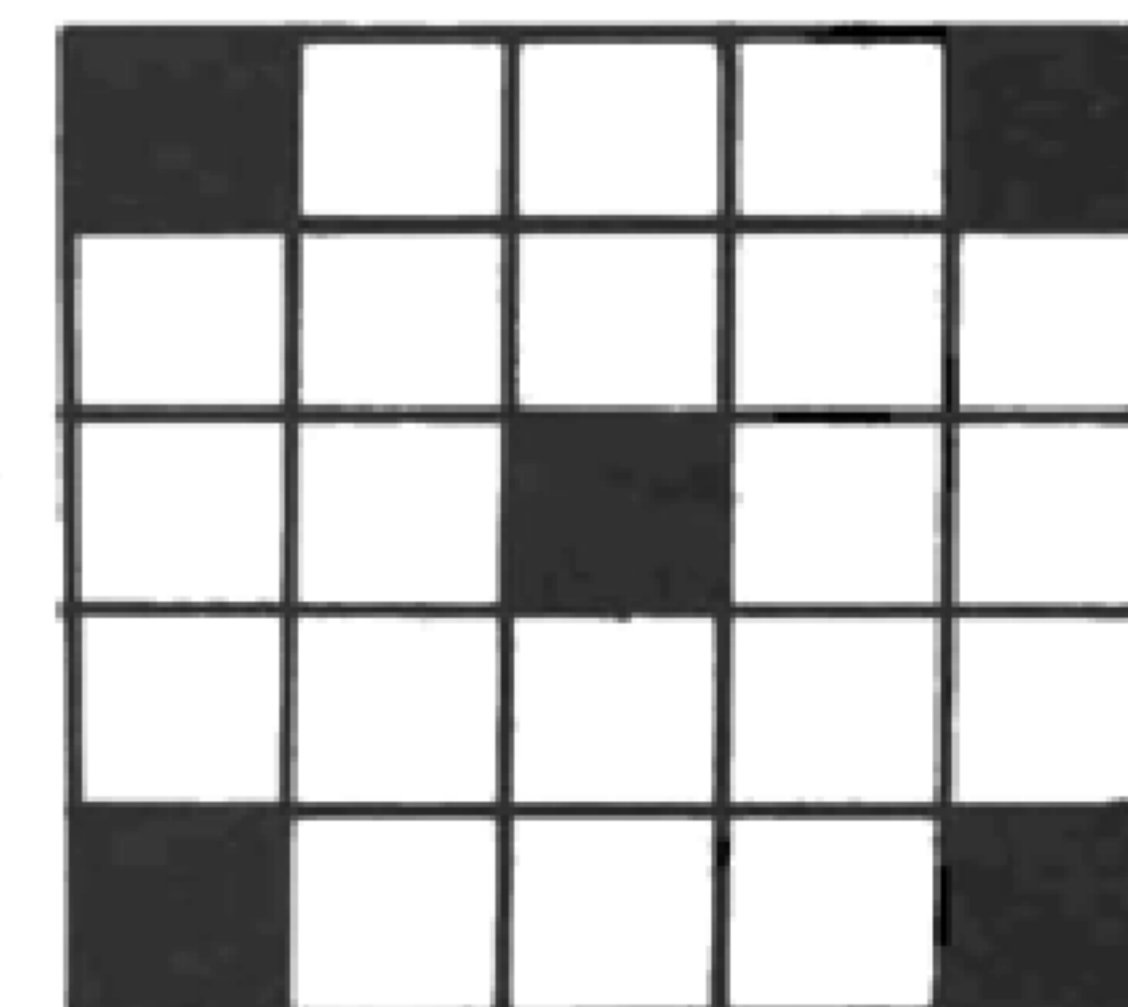
A.M.A.

REVERSE CROSS FIGURE

submitted by
Mr. D. Hinch, of Canterbury.

The answers to the cross figure are given below. Fit them into the block on the right.

10, 11, 20, 21, 304, 314, 516, 526, 37193, 48104, 57085, 69206.

LIFE AND DEATH

In a wood, there lived a certain number of cats, birds and snakes. Every morning each cat ate one bird. Every lunchtime, each snake ate one cat and every night, each bird ate one snake. After a few days, there was only one bird left.

How many of each were there before breakfast on the previous day?

A.M.A.

SQUARE FUN?

A square playground has a length of side of 30 metres, correct to one significant figure. It is paved with one metre square concrete paving slabs. These slabs are bought in units of 50. If 15 of these units are required to ensure that there are enough slabs and if the playground can be paved using only whole slabs, what is the exact area of the playground?

C.B.A.

A NOVEMBER PLOT

To plot this picture, you need paper marked with half-centimetre squares. Draw axes for x from 0 to 6 and for y from 0 to 8, using 2 cm for each unit.

(2, 1¾) (1½, 2) (1½, 1) (1¼, ½) (1½, ½) (1¾, ¾) (1¾, 1)
(2, 1¾) (2¼, 1¾) (2¾, 3) (3, 1¾) (3½, 1¾) (3¾, ¾) (4, ¾) (4¼, ½)
(3½, ½) (3½, ¾) (3, 1¾) (3½, 1¾) (3¾, 2) (3½, 3¾) (3¼, 4) (3½, 5)
(4½, 5) (4¾, 5¼) (4¾, 4¼) (5, 3¾) (4½, 3½) (4¼, 3¼) (4½, 3)
(4½, 2¾) (4, 2½) (3¾, 2½) (3½, 3¾) (3, 3½) (2¾, 4) (2¼, 3½) (2, 4)
(1½, 2) (1, 1¾) (¾, 1¾) (1½, 3½) (1¾, 5) (2, 5¼) (2¼, 4½) (2¼, 4¼)
(2, 4)

New line: (4½, 6) (4, 5¾) (3¾, 5½) (3³/₈, 5¾) (3¼, 5½) (3, 5½)
(2¾, 6) (2¼, 6) (1¾, 5¾) (2½, 5¼) (2¾, 5¼) (2⁷/₈, 5¾) (2½, 5½)
(2¼, 6) (1¾, 5¾) (1½, 5½) (¾, 4) (½, 3½) (½, 3½) (¾, 3¾) (1, 3½)
(1, 3¾) (1½, 4½) (1¼, 4¼) (1¾, 5)

New line: (3½, 6) (3¼, 5¾) (3, 5¾) (2¾, 6) (2¾, 6¼) (2¼, 6½)
(2¾, 6½) (3, 7¼) (3½, 7¼) (3½, 6½) (4¼, 6¼) (3½, 6¼) (3½, 6)
(3³/₈, 5¾) (3¾, 5¼) (4¼, 5¼) (4½, 5½) (4¼, 5½) (4, 5¾)

New line: (4¾, 5¼) (5¼, 5¾) (5½, 6) (5¾, 6) (5½, 5¾) (5½, 5)
(6, 5) (6, 5¾) (5¾, 6) (6, 6¼) (5¾, 6³/₈) (5, 6) (5½, 5½)

New line: (2¾, 6¼) (3, 6½) (3½, 6¼)

Using straight lines, join the points in the order they are given.

E.G.

The sequence should be divided into two parts, the first two digits come from $20+0^3$, $20+1^3$, $20+2^3$, $20+3^3$, $20+4^3$ must be the next two digits in the sequence, i.e. 84. This sequence ends here as $20+5^3$ is 145.

The other two digits follow the sequence 7^2+3, 6^2+3, 5^2+3, 4^2+3, so that the next pair will be $3^2 + 3$ or 12.

The next four-figure number will be 8412.

Ed.

SOLUTIONS TO PROBLEMS IN ISSUE NO. 96

Factorials $1! + 4! + 5! = 145$.

A calculating problem — or is it? Write each number as a power of 2 and the highest power gives the largest number which is 2^{39}.

Vat is das The final result would be the same for the diner but the waiter would object as his service charge would be smaller. The operation is said to be commutative.
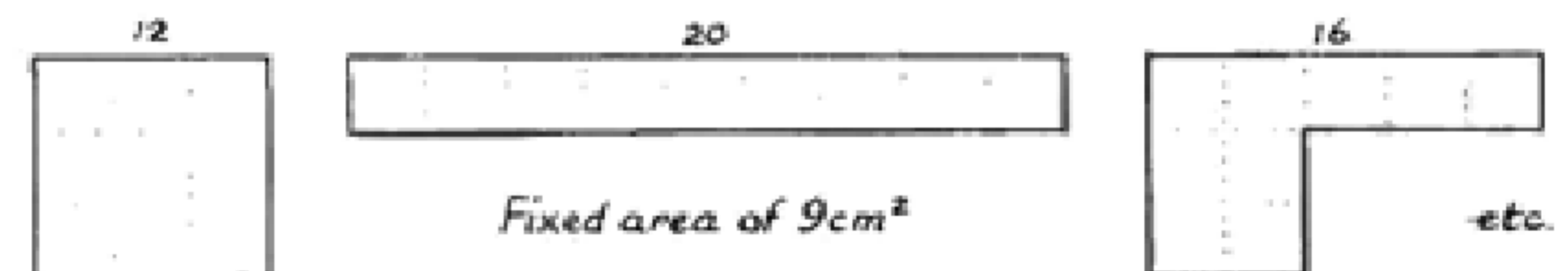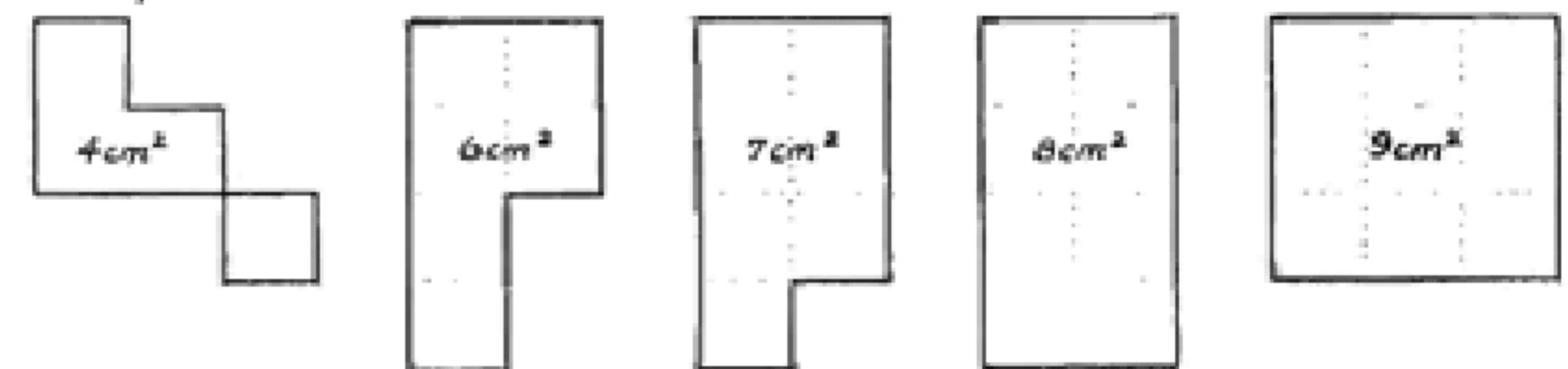
A power game 7^{55} ends in 3 as the sequence of the last digit is $7, 9, 3, 1$ repeated.

In the air The plot gave an aeroplane.

The tithe of war The original number of men was 24 000.

How far round

Fixed perimeter of 12 cms.
4cm² 6cm² 7cm² 8cm² 9cm²
12 20 16
Fixed area of 9cm² etc.

Do we know enough? The end is a rectangle with diagonals 20 units and sides 10 and $10\sqrt{3}$ units, the length is $10\sqrt{3}$ units, hence the volume is $3\,000$ cm³.

Double trouble Ask one of the twins the question "If I asked your twin brother what is your name?, how would he reply?". The twin NOT asked the question would be the answer.

by a burning glass. The shadow cast by a bar was used to tell the time as in sundials today. The disadvantage of this form of time keeping is that it does not work in cloudy conditions.

Some instruments measure the passage of time. The hour glass contained sand which flowed through a small opening from one chamber to another and was used for timing sermons in church. The modern timers tend to be used for ensuring that an egg is boiled for the correct period of time or for timing moves in some children's games.

C.B.A.

JUNIOR CROSS FIGURE No.71

Clues Across
1. $314 + 43$ in base-five.
3. Sum of averages of each set in 1-down.
5. Perimeter of a square with an area of 400 cm2.
6. Distance (in km) travelled in 2¾ hours at an average speed of 72 km h⁻¹.
7. $10\frac{1}{20} - 2\frac{4}{5}$ (Answer as a decimal fraction).
10. One of two equal angles in an isosceles triangle which has a third angle of 47º.
12. 23×3 in base-five.
14. Area of parallelogram in 9-down.
16. $\overline{AD}$ if $\overline{AB} = (5,2)$, $\overline{BC} = (-3,5)$ and $\overline{CD} = (2,-2)$.
17. 29.

Clues Down
1. $[2,4,6,8] \cap [4,8,12]$.
2. Solution to 1-across in base-ten.
3. A prime number.
4. Number of minutes from 21.45 hours to 04.05 hours.
6. $54.6 \div 3.5$.
8. 2.6352 expressed correct to 3 significant figures.
9. Vertex "C" of parallelogram ABCD in which A = (0,1), B = (4,5) and D = (7,0).
11. $[5,3] \cup [3,1]$ in descending order of size.
13. Value of x if $4x - 3 = 7$.
15. $8\frac{1}{4} \div \frac{3}{8}$

D.I.B.

IN THE BALANCE

In issue No. 94, the question "A grocer has a faulty balance which only gives 990 grams when it is registering 1 kilogram. How much extra profit has he made in selling a sack of sugar for £25?" was asked. The solution given 25¼p was wrong.

Let us suppose that each bag contains 1 kilo of sugar. Using the false weight, he is saving 10 gm of sugar on each bag. So that each 99 bags have been used, he has saved 10 x 99 gm, i.e. he has another false bag. So 99 bags make up 100 false kilos.

Let the intended selling price be £y per kilo, which is also the price of a false kilo. The 99 bags should have sold for £99y but they will actually produce £100y, the extra profit is £y, so each bag produces an extra £$\frac{y}{99}$. The 99 bags produced £25 each so that 99 bags will have sold for £99 x 25.

Hence $99 \times 25 = 100y$, or $y = \frac{99 \times 25}{100}$.

The extra profit per bag is $\frac{y}{99}$, which equals $\frac{99 \times 25}{100 \times 99}$ pounds, which is 25p and not 25¼p as given in the solutions.

Ed.

ODD ONE OUT No. 1

with apologies to Paul Daniels.

Which is the odd one out in each of these sets? (– and why?)
A = 3, 5, 8, 9 ,   B = 3, 7, 9, 11 ,   C = 1, 9, 12, 16 ,
D = five, six, seven, eight .

E.G.

That's all very interesting, Pythagoras – But will it help me get a job?

ALL SQUARE

1	2	3
2	3	1
3	1	2

In the diagram on the left, you will notice that each of the digits 1, 2 and 3 appears once and once only in each row and each column. On the other hand, only one of the diagonals has this property, the second one being 3, 3 and 3.

Can you place the digits 1, 2, 3 and 4 in the square on the right so that each digit appears once and once only in each row, each column and each diagonal.

R.H.C.

Time throughout Time

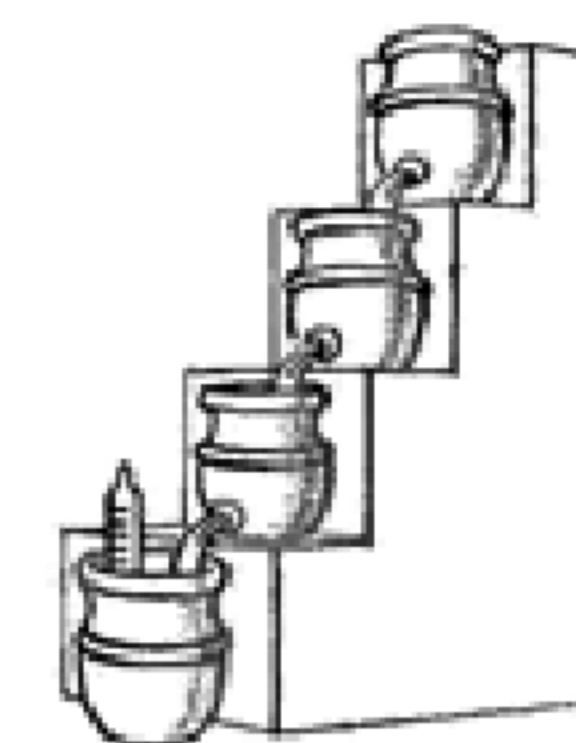Ancient Egyptian Obelisk

Egyptian Sundial
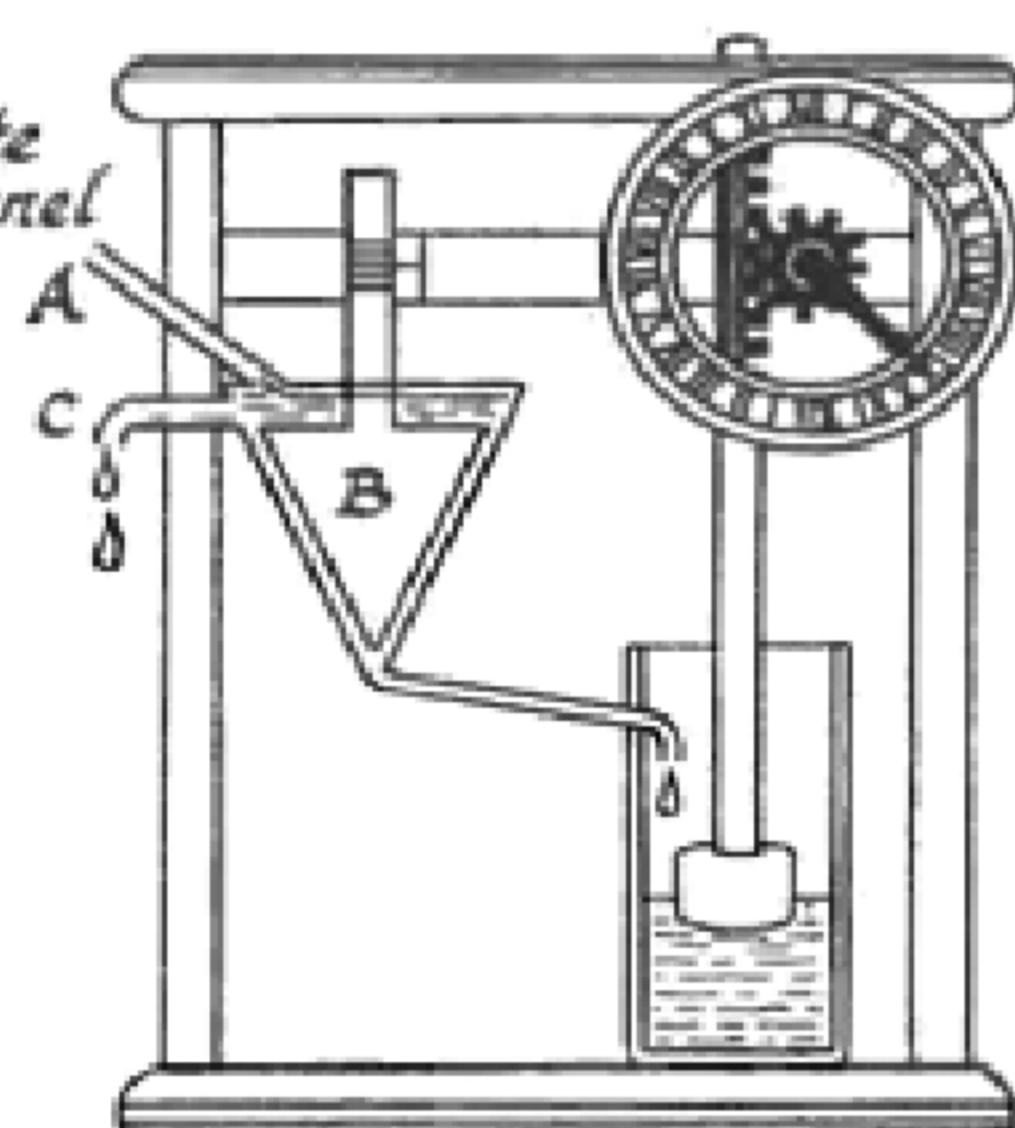
Medieval Sundial

Farmyard Cockerel

Marked Candle

Hourglass of Canton - China

A = water inlet
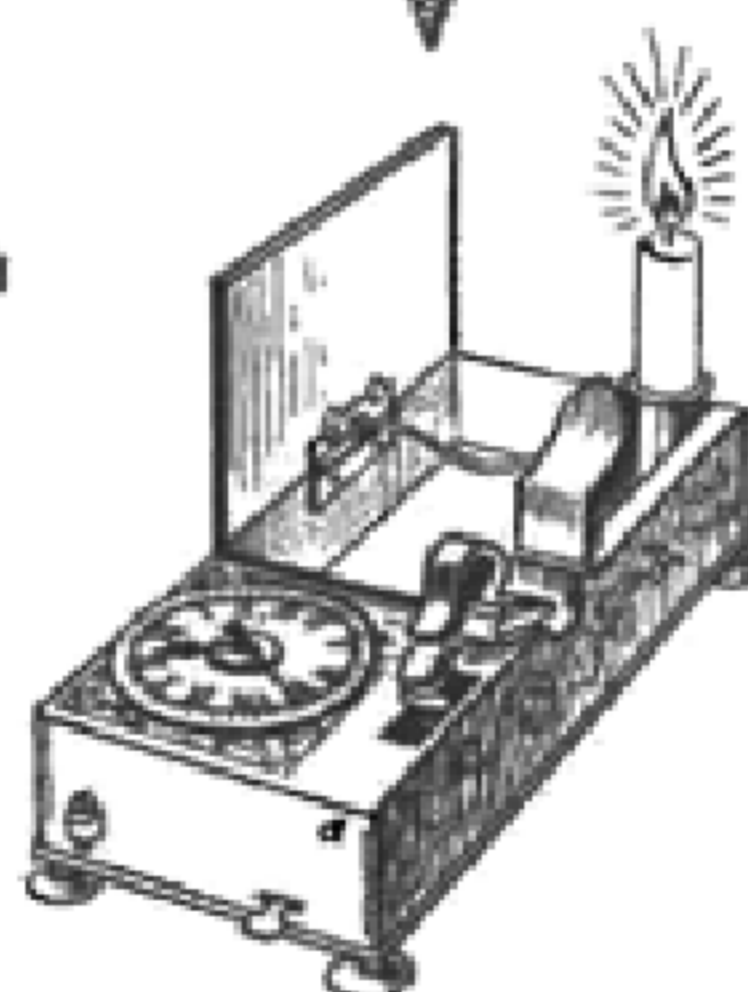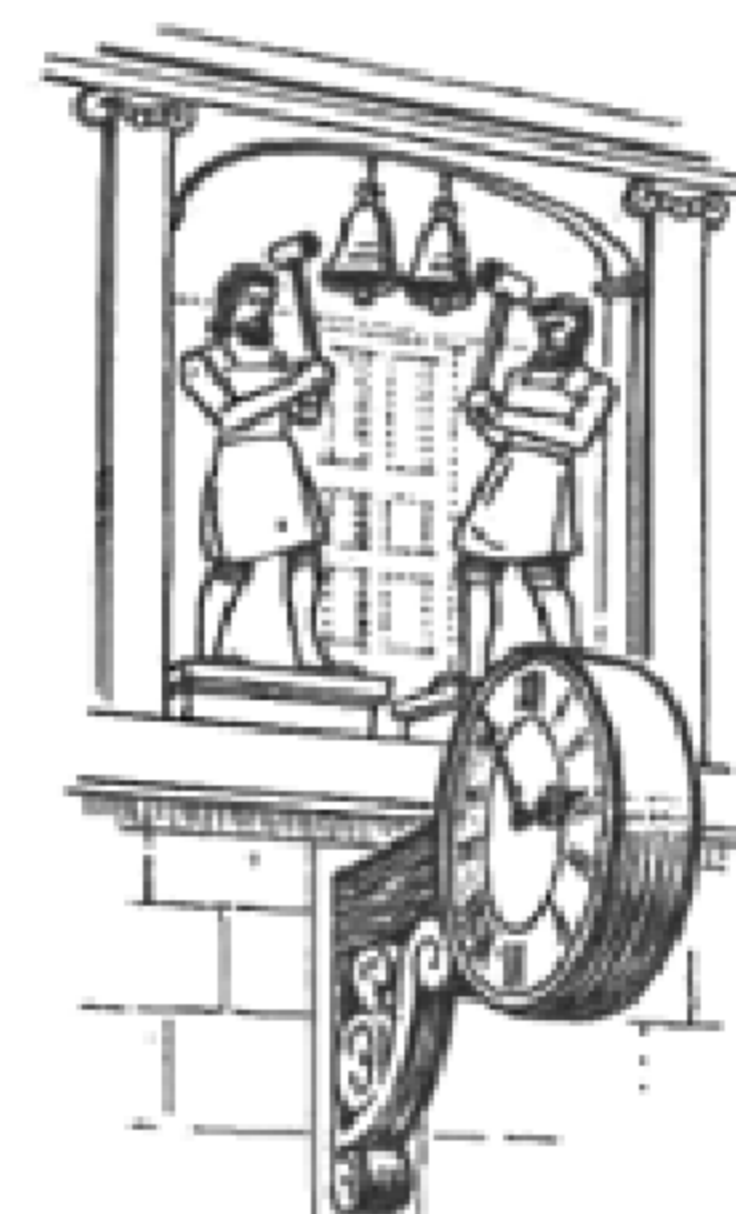B = cone to regulate water through funnel
C = overflow

Hour Glass
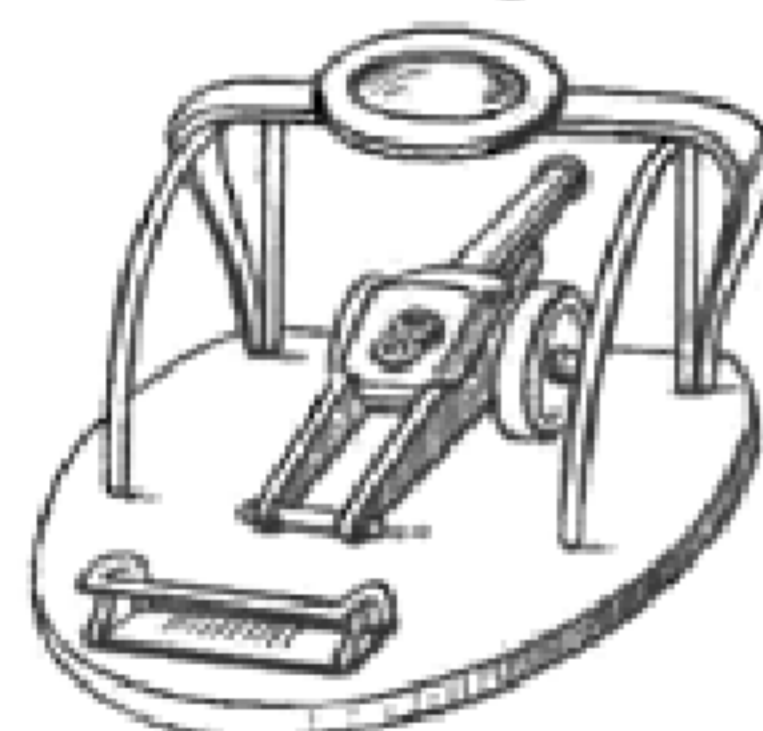
Early Water Clock

Cuckoo Clock

Figures known as 'Jacks'

Village Church Clocks

Big Ben

Midday Signal Cannon

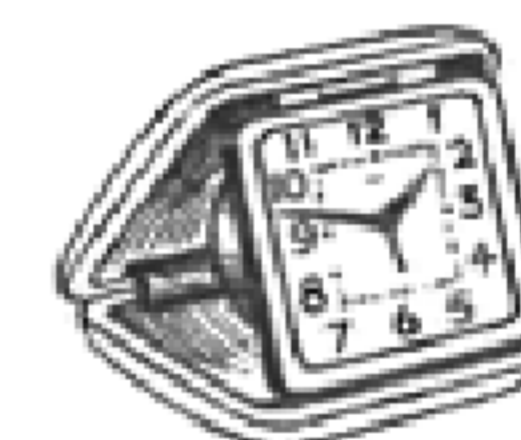An Early Alarm Clock

Simple Alarm Clock

Travel Alarm Clock

Digital Clock

TIME THROUGHOUT TIME

Time is one aspect of Mathematics that has been of great interest to many people. We have devised many different ways of telling the time from the humble candle clock to the modern digital clock. One of the earliest timers was the farmyard cockerel; although it was not very accurate, it made full use of the daylight hours. Water has been used in a variety of ways to tell the time and two methods are shown in the diagram.

Clocks vary in size ranging from the humble wrist watch to large public clocks like Big Ben. Some clocks were designed to entertain as well as to tell the time. One of the most famous is to be found at Wells where moving figures, known as JACKS, ring out the hours. A more humble form is the Cuckoo clock. Other ways of calling attention to a particular time are alarm clocks and some of the early models were ingenious. The mid-day cannon was primed and the powder was set off by the rays of the sun being focussed