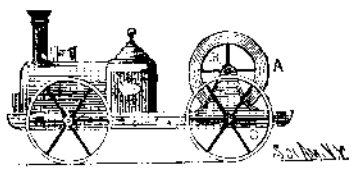
SCIENCE IN TOYS.

I.

One who knows all of science that may be learned from toys is truly an advanced scholar, inasmuch as there is scarcely a branch of physics that is not in some way represented in toys. It is true that it is sometimes difficult to distinguish between scientific instruments and toys. In the light of the accepted definition of the word toy, viz., "a thing for amusement, but of no real value," some overpractical individuals might class a large proportion of physical instruments as mere toys, while, on the other hand, the simplest plaything might, in the estimation of a scientific man, have great value as an illustration of some fact in science.

The collection of toys illustrated is by no means as extensive as it might be; but it is quite sufficient to show that a great deal of scientific knowledge may be gained by the study these seemingly insignificant things.

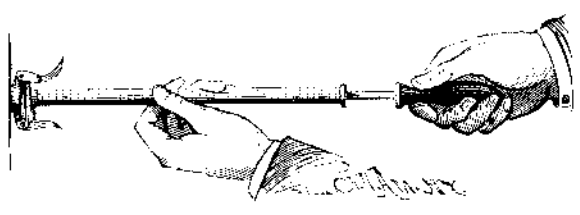
The property of inertia, the storage of power, the transfer of power by friction, and the conversion of rotary into rectilinear motion, are illustrated by the locomotive shown in the annexed engraving. The flywheel, A, is mounted on the shaft, B, which rests on the supporting and driving wheels, C. The wheel, A, is spun by means of a string in the same manner as a top. By virtue of its inertia, the wheel, A, tends to continue its rotary motion. If unaffected by outside influences, it would run on forever; but the friction of its bearings and of the air, gravitation, and the earth's magnetism, all combined, soon bring it to rest.



INERTIA LOCOMOTIVE.

The power imparted to and stored in the wheel, A, is given out in turning the wheels, C, overcoming friction, and propelling the machine forward.

The compression and elasticity of gases, the generation of heat by compression, the transference of force by means of a gaseous body, the disruptive power of


THE POPGUN USED AS A PNEUMATIC SYRINGE—IGNITING TINDER.

compressed air, and the impact of air on air, are all illustrated by the simple toy known as the popgun.

The popgun shown in the engraving* is perhaps the best one in the market for the purpose, but any other of good construction will answer. This particular one is arranged for clamping a piece of strong paper across the end of the barrel; but to permit of creating a strong pressure, and also to allow the operator to readily look inside the barrel, a piece of thick mica is substituted for the paper.

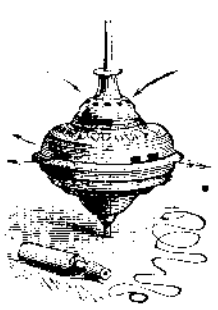
When the end of the popgun is placed against the wall, and the piston is pushed in, the volume of air contained by the barrel is greatly reduced. When the piston is released, it immediately returns toward the point of starting; the pent-up and compressed air exhibiting its elasticity by acting as a spring in pushing back the piston.

Tinder placed in the popgun will be ignited when the piston is quickly and forcibly pushed in while the air is confined by the mica plate.

When the end of the gun is removed from the wall and the thick mica plate is replaced by a thin one, a sufficient pressure will burst the plate, showing that the power applied to the piston has been transferred by the air to the mica plate.

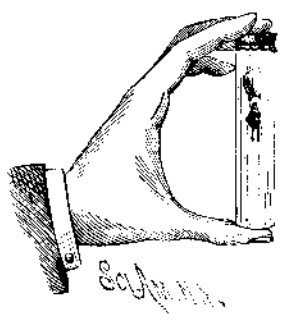
The impact on the surrounding air of the air suddenly discharged by the gun produces a sound like that caused by the forcible contact of two solid bodies.

Centrifugal action is beautifully exhibited by the ordinary choral top. As the top spins, air, entering the holes at the top, is discharged through the holes at the equator by centrifugal action. The air, in going through the top, passes through a series of reeds, setting them in vibration, producing agreeable musical sounds.


THE CHORAL TOP.

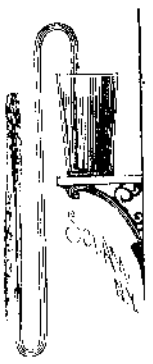
Another top recently described in these columns exhibits centrifugal action by means of a liquid.

The hydrostatic toy known as the Cartesian diver illustrates the several conditions of floating, immersion, and suspension in equilibrium. In a tall, slim glass tube, closed at the bottom and nearly filled with water, is placed a porcelain or glass figure having a glass bulb attached to its head. The glass bulb has a small hole in the bottom, and is filled partly with water and partly with air, the proportion of air and water being such as to just allow the bulb to float. The top of the tube is closed by a piece of flexible rubber tied over its mouth. The pressure of the fingers upon the rubber communicates pressure through the water to the air contained by the bulb, causing the air to occupy less space and increasing the weight of the bulb in proportion to the amount of water forced in. As the weight of the bulb increases the diver descends, and when the finger is removed from the elastic cover of the tube, the air regains its normal volume, and the bulb, becoming lighter, rises to the top of the jar.


THE CARTESIAN DIVER.

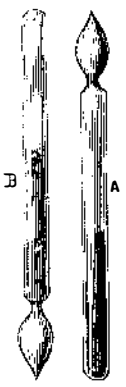
The toy hydrogen balloon and the hot air balloon act in the air in the same manner as the air-filled bulb in the water.

The simple siphon embodies all of the principles of hydraulics. It is a pump in which the water itself acts as a continuous piston, the piston being constantly discharged and renewed. It shows the forcible projection of water, and illustrates the various conditions of raising and forcing water, and of its conveyance through pipes.


SIPHON.

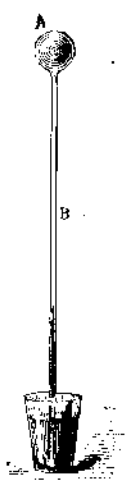
The water hammer consists of a vacuum tube, partly filled with water or other liquid. A sudden downward and upward movement of the tube, when held in the position shown at A, causes the liquid to leave the bottom of the tube as the tube goes down, and strike forcibly on the bottom of the tube as the tube moves up. The liquid meets with no resistance, and in striking produces a sharp metallic clink, which sounds like the breaking of glass.

This tube shows, on a small scale, what happens in steam pipes when they give forth the sharp, detonating sounds so often heard in the pipes of steam heating apparatus. The steam, by condensation, produces a vacuum, into which the water rushes with great velocity, and meeting with no air resistance strikes the end of the pipe or another body of water, producing a sound suggestive of the bursting of the pipes.



WATER HAMMER.

When the tube is inverted, as shown at B, and the bulb is held in the hand, the rapid evaporation, by the warmth of the hand, of the liquid flowing through the narrow neck of the tube and down the inner surface of the bulb creates a pressure of vapor, which finds exit through the neck of the tube, and bubbles up through the main body of the liquid, and is condensed either in the liquid or above it. Sometimes the tube, when designed for use in this way, contains the figure of an imp, which the ebullition of the liquid agitates violently.



AIR THERMOMETER.

The air thermometer, consisting of an air bulb, A, and capillary tube, B, plunged in a colored liquid, shows changes in the volume of air due to expansion and contraction under changes of temperature by the rising or falling of the column of the colored liquid in the capillary tube. It is a sensitive thermometer, but of little practical value, on account of the variability of the volume of air by barometric changes.

G. M. H.

* This toy was patented in 1868 by Charles Kirchhoff, who, it is said, realized handsome profits from his invention.

Mercuric Chloride in Diarrhœa.

It is seldom that an allopathic practitioner acknowledges indebtedness to the homœopathic school, but this is what Dr. Millard, of Edinburgh, does in a letter to the *British Medical Journal* regarding the use of mercuric chloride in diarrhœa, to which we have previously referred. He writes:

"I did not obtain my information of the use of hydrarg. perchlor. in this form of diarrhœa from Dr. Ringer's excellent work, as Dr. Macdonald perhaps supposes, but from probably the same source that Dr. Ringer obtained his, of which, to any one that knows, the book bears many traces, namely, from homœopathic treatises. But it matters not whence the knowledge comes—I know it to be an excellent remedy in the form of diarrhœa I previously described. If not adopted too late in the case, it is invariably successful. I have lately had four cases to test its merits; two recovered, and two were in a state of almost collapse when seen, one of these dying one hour after my first visit. In the other, the diarrhœa was checked after three or four doses, but the infant, a very weakly child, died from convulsions a few hours afterward."

Domestication of the Buffalo.

A gentleman is now successfully domesticating the American buffalo at Stony Mountain, Manitoba. Starting his herd in 1878 with four heifer calves and one bull, it now numbers sixty-one head; the greater number pure buffalo, the rest half breeds. When we saw them in January, all were sleek and fat, and yet they were then living on the open prairie and feeding on the prairie grasses covered by snow. At this time the snow was deep and the thermometer had, for long, registered 20° or more below zero. In January of the preceding year one of the cows had calved on the plain, and although at the time the thermometer registered 38° below zero, neither cow nor calf appeared to suffer in the least. When a blizzard comes on, the animals lie down together, with their backs to the wind, and allow the snow to drift over them, so that under the combined protection of their own wool and the snow they are quite warm. Not one of this herd has ever exhibited the slightest symptoms of disease, although the only care they receive is occasional watching, to prevent them from straying away. Thus, winter and summer, they live and thrive on the bare prairie, with numbers undiminished by any of the ordinary cattle scourges, and with expenses for care reduced to a minimum.

Once a year the great fleece, weighing from ten to fourteen pounds, is shed, and its manufacture into thick warm cloth was at one time a regular industry at Winnipeg, until it was discontinued by the extirpation of the animals in the adjoining region. In its market value, the buffalo is not behind its smoother relative; for even if the quality of the meat is inferior, the difference is more than made up by the great weight of the animal and by the value of the robe, which usually brings from ten to fifteen dollars. As draught animals, they have proved a success; for notwithstanding their great strength, endurance, and activity, they are as easily handled as ordinary oxen. In one particular only is the buffalo far inferior to other species of cattle, and that is as a milker; but to the ranchman milk is really of no consequence.

Mr. Bedson, the owner of the herd, after experimenting with crosses, is well satisfied with the hybrid, as it is in shape more like the domesticated cow, and is also a fair milker. Yet we doubt that this gain is sufficient to compensate for the deterioration of the fur; while, also, it would be a matter of endless regret if, in the prosecution of these experiments, the original pure race were lost. The rate for increase of the buffalo, though theoretically the same as with other cattle, is really much higher, on account of the lower rate of mortality.

When the present herd is sufficiently increased, it is intended to divide it among several prairie ranches in localities where once the wild buffalo found its choicest pastures. This amounts almost to a restocking of the buffalo region.—*Agriculturist.*

Street Railway Traffic in New York.

During the year ending Sept. 30, 1886, there were carried on the street railways of New York city 325,427,015 passengers. We believe this is by far the greatest passenger traffic of any city in the world, although New York is not the largest city. By way of comparison, the figures of 1885 are placed in a parallel column

ROAD.	1885.	1886.
Broadway and Seventh Avenue	21,952,529	32,698,899
Central Cross Town	3,666,617	4,044,913
Central Park, North and East River	15,066,770	15,155,902
Christopher and Tenth Streets	4,316,777	4,209,426
Dry Dock, East Broadway and Battery	17,419,852	17,154,601
Eighth Avenue	13,664,391	13,353,261
Forty-second and Grand Street Ferry	8,208,552	7,446,644
Harlem Bridge, M. and F.	3,296,738	3,637,357
Houston, West St., and Pavonia Ferry	4,352,704	4,592,634
New York and Harlem	15,972,361	18,201,236
Ninth Avenue	4,175,580	4,459,089
Second Avenue	19,367,370	21,059,707
Sixth Avenue	16,998,137	16,788,059
South Ferry (returns of 1884)	546,851	*550,000
Third Avenue	32,000,000	27,750,000
Twenty-third Street	10,311,145	12,697,914
Manhattan Elevated	103,354,729	115,109,591
Forty-second Street and St. Nicholas	2,445,587	6,016,782
Total passenger traffic	297,116,690	325,427,015

* Estimated.

The Fastest Torpedo Boat.

An official trial lately took place at Gravesend of the last new torpedo boat built by Yarrow & Co. for the British Government. A continuous run of two hours was made, during which were six runs of the measured mile. The average speed during the entire run was 22·39 knots per hour. The highest speed on two of the mile runs was 23 knots per hour, or about 26½ miles per hour. Length of the boat, 125 ft.; beam, 13 ft.; mean draught, 3 ft. 4 in.; load carried, 10 tons; vibration, practically none; circle, 80 yards in 59 seconds; steam pressure, 140 pounds; highest revolutions per minute, 411.